JPRS 79948

27 January 1982

Japan Report

No. 143

NATIONAL SPACE EFFORT

FBIS FOREIGN BROADCAST INFORMATION SERVICE

NOTE

JPRS publications contain information primarily from foreign newspapers, periodicals and books, but also from news agency transmissions and broadcasts. Materials from foreign-language sources are translated; those from English-language sources are transcribed or reprinted, with the original phrasing and other characteristics retained.

Headlines, editorial reports, and material enclosed in brackets [] are supplied by JPRS. Processing indicators such as [Text] or [Excerpt] in the first line of each item, or following the last line of a brief, indicate how the original information was processed. Where no processing indicator is given, the information was summarized or extracted.

Unfamiliar names rendered phonetically or transliterated are enclosed in parentheses. Words or names preceded by a question mark and enclosed in parentheses were not clear in the original but have been supplied as appropriate in context. Other unattributed parenthetical notes within the body of an item originate with the source. Times within items are as given by source.

The contents of this publication in no way represent the policies, views or attitudes of the U.S. Government.

PROCUREMENT OF PUBLICATIONS

JPRS publications may be ordered from the National Technical Information Service, Springfield, Virginia 22161. In ordering, it is recommended that the JPRS number, title, date and author, if applicable, of publication be cited.

Current JPRS publications are announced in Government Reports Announcements issued semi-monthly by the National Technical Information Service, and are listed in the Monthly Catalog of U.S. Government Publications issued by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Correspondence pertaining to matters other than procurement may be addressed to Joint Publications Research Service, 1000 North Glebe Road, Arlington, Virginia 22201.

JPRS 79948

27 January 1982

JAPAN REPORT

No. 143

National Space Effort

Tokyo JAPAN IN SPACE in English 1981 pp 1-28

[Published by KEIDANREN (Federation of Economic Organizations) under editorial supervision of Research Coordination Bureau, Science and Technology Agency]

Contents

Photo--HINOTORI Launch..... 1

Photo--KIKU-3 Launch..... 2

National Organization for Space Activities..... 3

Budget for Space Activities..... 9

Brief History of Space Activities..... 9

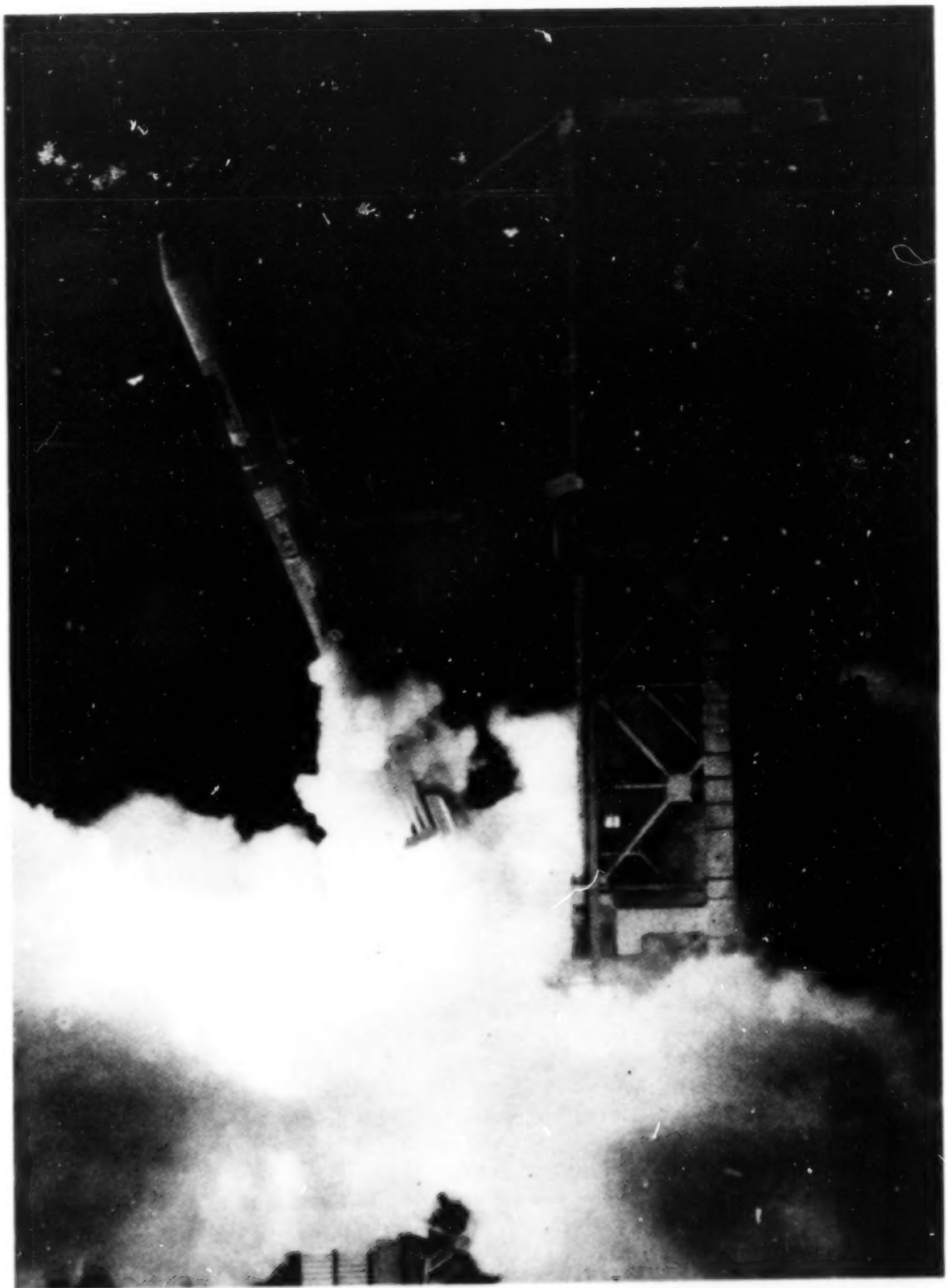
Space Activities in Japan..... 11

- Development of Satellites..... 11
- Development of Launch Vehicles..... 18
- Materials Processing in Space..... 23
- Remote Sensing..... 24

International Cooperation..... 24

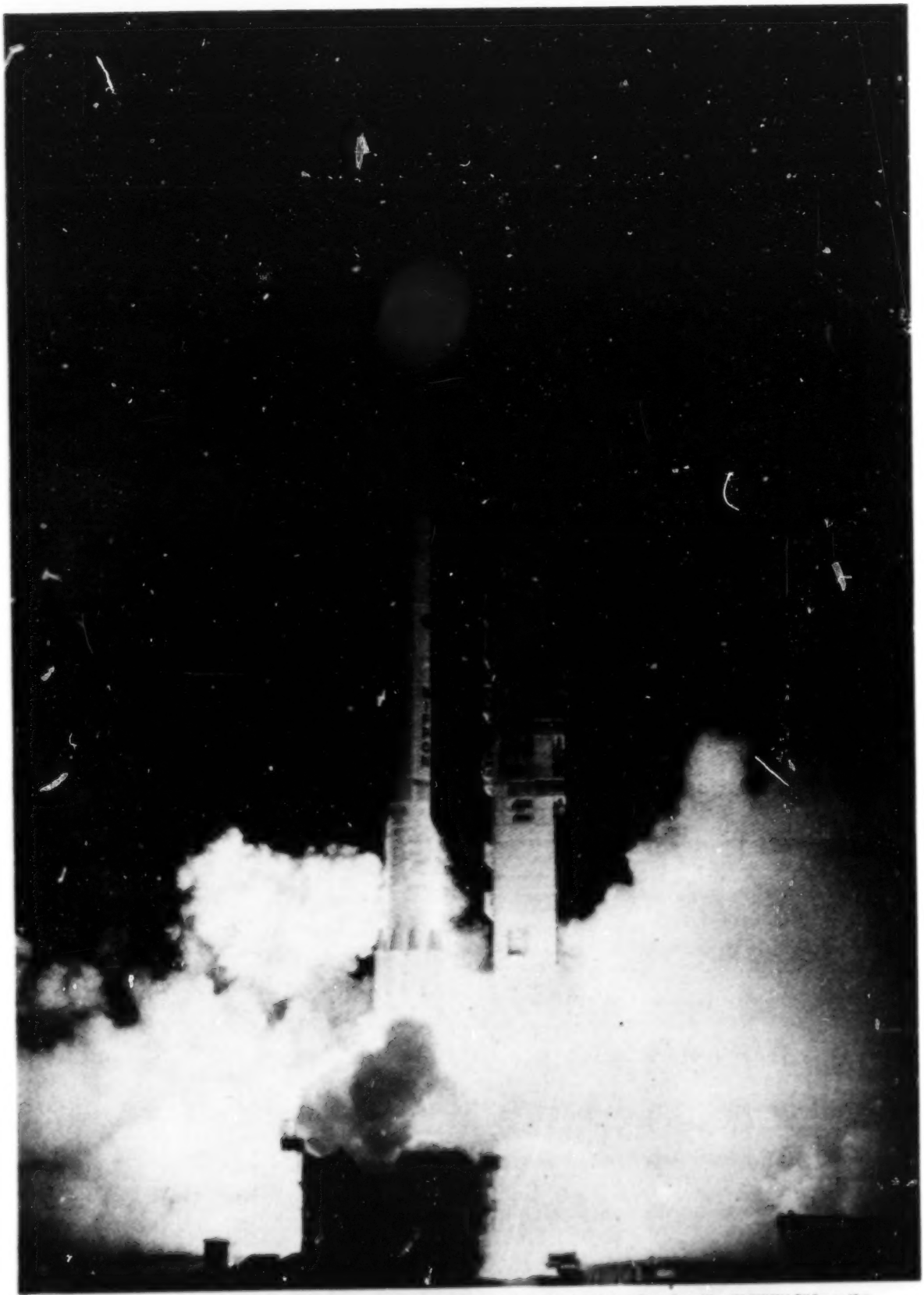
Industry's Role in Space Research..... 25

Appendix: The summary of the Outline of Japan's Space Development Policy.... 44



The Institute of Space and Astronautical Science (ISAS)* launched, by means of the M launch vehicle, the seventh scientific satellite (ASTRO-A) "HINOTORI" from the Kagoshima Space Center on Feb. 21, 1981.

* The Institute of Space and Aeronautical Science (ISAS), University of Tokyo, was reorganized into the Institute of Space and Astronautical Science (ISAS) in April 1981.



The National Space Development Agency of Japan (NASDA) launched Engineering Test Satellite-IV "KIKU-3" from the Tanegashima Space Center on Feb. 11, 1981, using the first N-II launch vehicle.

1. National Organization for Space Activities

Space development in Japan is executed in a comprehensive and systematic way under the leadership of the Space Activities Commission (SAC), the advisory organ to the Prime Minister.

SAC consists of the chairman (the Minister of State for Science and Technology) and four commissioners. The main task of SAC is to deliberate and to decide on important matters related to space development. SAC is authorized to submit its opinions to the Prime Minister. SAC formulated "Outline of Japan's Space Development Policy" in March 1978, which set forth guiding principles of Japan's space activities for the next 15 years. Besides, SAC decided on "Space Development Program" to implement "Outline of Japan's Space Development Policy" and reviews it every year.

The Prime Minister, based on SAC's decision, decides the government's basic space development program and the related administrative organs conduct research and development according to it.

The central body of space development is the National Space Development Agency of Japan (NASDA). NASDA takes charge of and undertakes the development of satellites and launch vehicles in the fields of application and the launching and tracking of satellites.

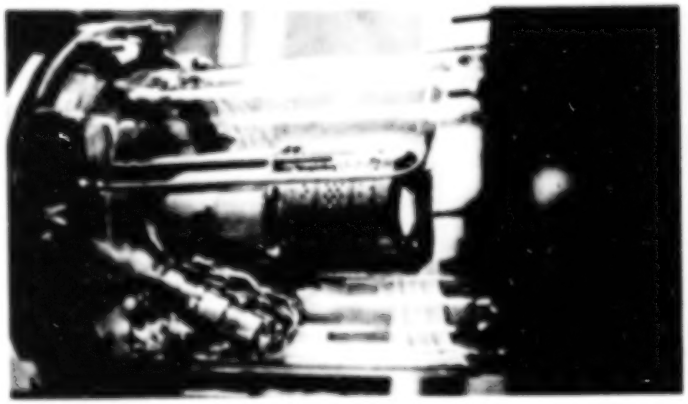
As for the space program in the fields of space science, the Institute of Space and Astronautical Science (ISAS) of the Ministry of Education undertakes research and development of scientific satellites and launch vehicles for launching them, and also performs launch.

(a) Space Activities Commission (SAC)

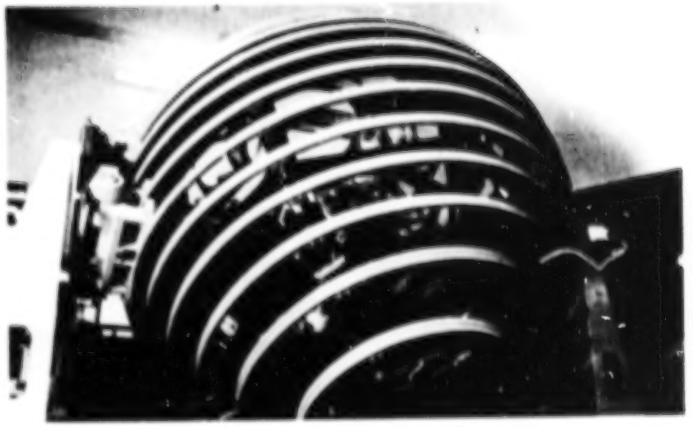
SAC was established in May 1968 by the Law for the Establishment of SAC, in order to centralize space activities of the various government agencies and to have them executed under the systematic program. The role of SAC is to plan, deliberate and decide important matters on space activities, and every year SAC reviews Space Development Program, estimates the space-related expenses and so on. The secretariat function of SAC is conducted by the Research Coordination Bureau of the Science and Technology Agency in cooperation with other administrative agencies.

(b) Science and Technology Agency (STA)

In addition to being a secretariat of SAC, the Research Coordination Bureau (RCB) is responsible for planning basic policies on science and technology concerning space development, international cooperation in space utilization, promotion of space utilization and supervision of NASDA.



NAL (Test of an ion engine)



ISAS (Magnetic test equipment for scientific satellite)

Kakuda Branch, NAL

Kagoshima Space Center, ISAS

The National Aerospace Laboratory (NAL), a research organization attached to STA, carries out researches on basic space technology.

(c) Ministry of Education (MOE)

The Institute of Space and Astronautical Science (ISAS), Ministry of Education, reorganized to be an independent national institute in April 1981 to succeed the activities of the Institute of Space and Aeronautical Science of the University of Tokyo, is the inter-university center for space researches by means of balloons, sounding rockets and scientific satellites, as well as the research and development of related space technologies.

(d) Ministry of Transport (MOT)

The Japan Meteorological Agency (JMA) is responsible for meteorological services using satellites and also observations using meteorological rockets. MOT also supervises NASDA.

The Electronic Navigation Research Institute (ENRI), a research organization attached to MOT, carries out researches on satellite navigation.

(e) Ministry of Posts and Telecommunications (MPT)

The Radio Regulatory Bureau (RKB) is responsible for planning and promoting policies on satellite-communications and satellite-broadcasting systems as well as the radio regulation in regard to space utilization, space development and space research.

It is also responsible for supervision of NASDA and the Telecommunications Satellite Corporation of Japan.

The Telecommunications Policy Bureau (TPB) supervises the Nippon Telegraph and Telephone Public Corporation (NTT), and the Kokusai Denshin Denwa Company Limited (KDD), which is the signatory to the INTELSAT and INMARSAT Operating Agreements.

The Radio Research Laboratories (RRL), a research organization attached to MPT, carries out researches on radio wave propagation, space communications, sensors for remote sensing of the earth's environment and so on.

(f) Other Government Agencies

The National Police Agency (NPA), the Environment Agency (EA), the Ministry of Foreign Affairs (MOF), the Ministry of Agriculture, Forestry and Fisheries (MAFF), the Ministry of International Trade and Industry (MITI), the Ministry of Construction (MOC) and the Ministry of Home Affairs (MHA) are also involved in space activities.

Meteorological Satellite Center, JMA

Tsukuba Space Center, NASDA

Kashima Branch, RRL

Tanegashima Space Center, NASDA

(g) National Space Development Agency of Japan (NASDA)

NASDA was established in 1969 under the NASDA Law and contributes to the promotion of the space development and space utilization solely for peaceful purposes.

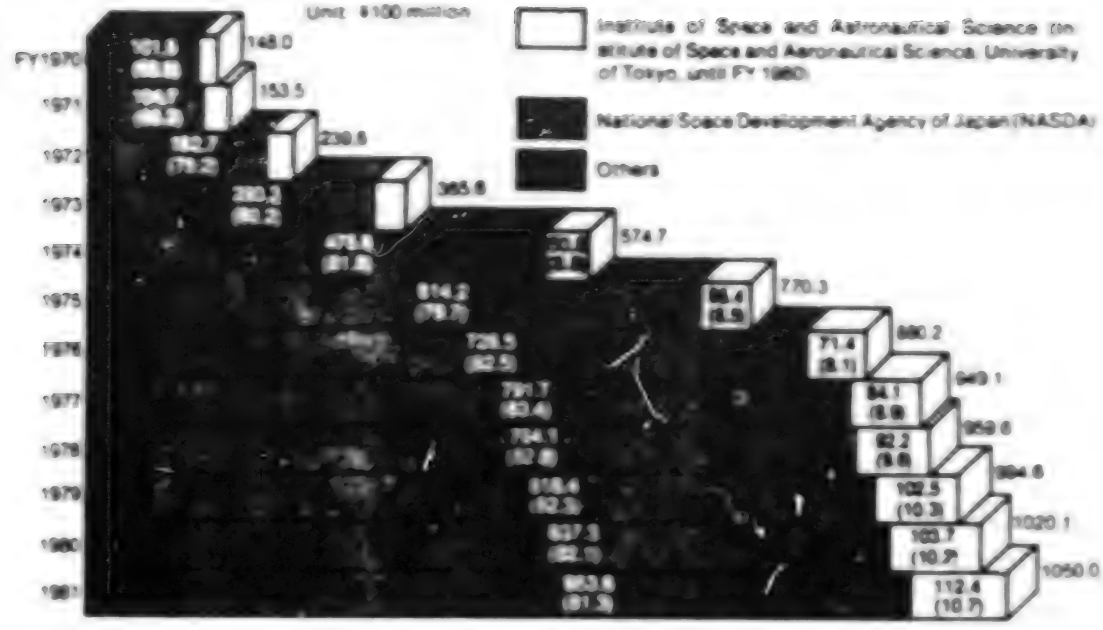
The main tasks of the Agency are:

- development of satellites, especially those for practical applications, such as communications, meteorological observation, etc.,
- development of satellite launch vehicles,
- development of ground support equipment and facilities, and
- launch operation, tracking and data acquisitions.

The funds necessary for NASDA activities are covered mostly by capital and subsidies provided by the government. In addition, it may obtain investments from non-governmental organizations.

■ Schematic Chart of National Organization for Space Activities

2. Budget for Space Activities



Notes: 1 The upper figure in each fiscal year shows the total budget for space activities.
2 Figures in parentheses indicate percentage (%) as against the total budget for each fiscal year.

3. Brief History of Space Activities

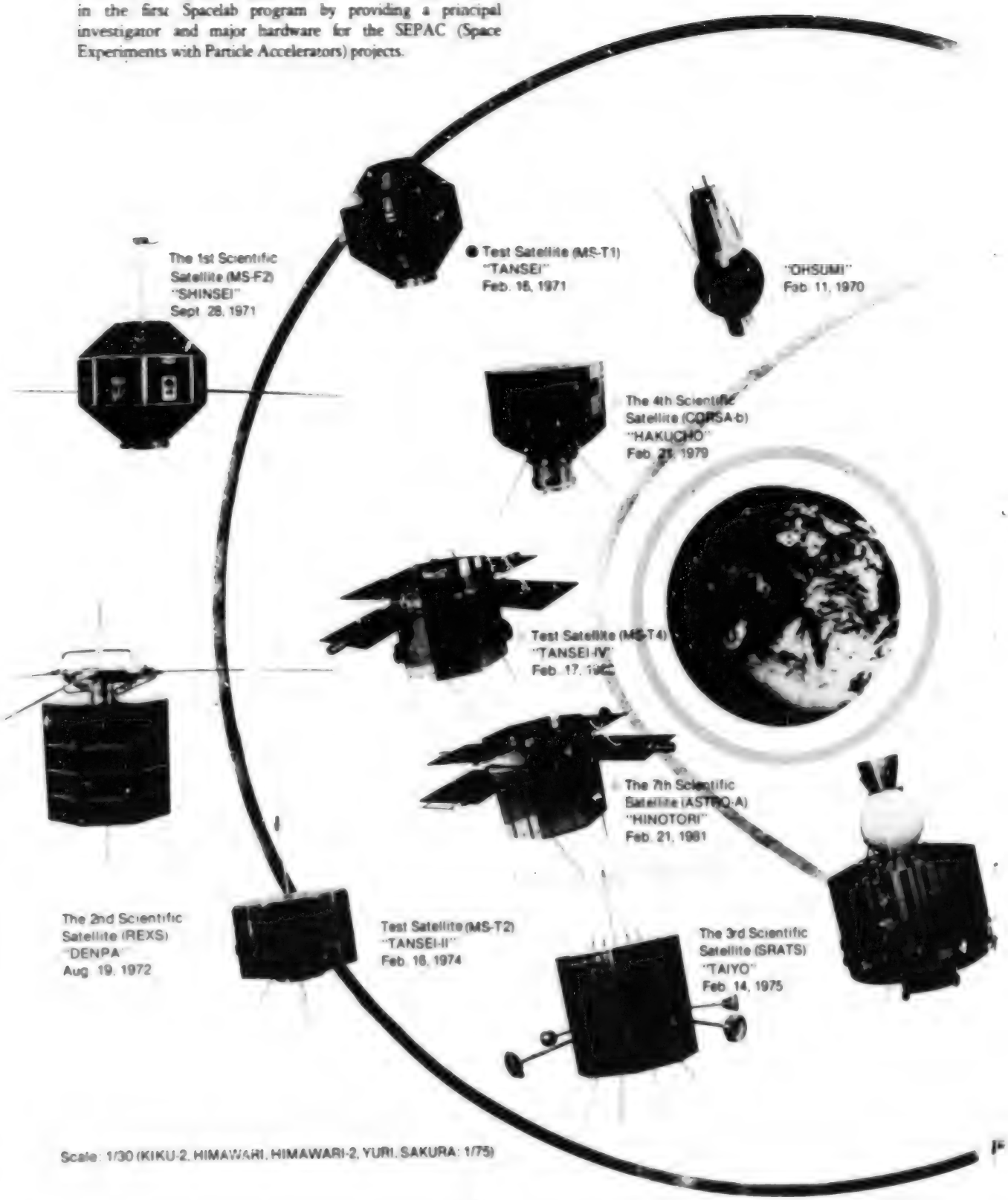
1955	Apr	The budget for the development of sounding rockets was appropriated for the first time to the Institute of Industrial Science, University of Tokyo.
	Aug. 8	The launch test of the Pencil rocket was conducted.
1956	May 19	The Science and Technology Agency was inaugurated.
1957	Oct. 4	The Soviet Union launched the world's first satellite "SPUTNIK 1."
1958	Jan. 31	The U.S. launched its first satellite "EXPLORER 1."
	Oct. 1	The U.S. set up the National Aeronautics and Space Administration (NASA).
1960	May 18	The National Space Activities Council (NSAC) was established in the Prime Minister's Office.
1961	Apr. 12	The Soviet Union launched the world's first manned spaceship "VOSTOK 1."
	Dec.	University of Tokyo opened a testing ground at Noshiro, Akita Prefecture.
1962	Feb. 20	The U.S. launched its first manned spaceship "FRIENDSHIP 7" (Project Mercury).
	Oct. 15	The Radio Research Laboratories, Ministry of Posts and Telecommunications, completed a 30-m parabola antenna for space communications tests at Kashima, Ibaraki Prefecture.
1963	Apr.	University of Tokyo started research and development of the MU-1 launch vehicle.
	Nov. 23	Japan-U.S. TV transmission was conducted for the first time via "RELAY 1" satellite of the U.S.
	Dec. 9	University of Tokyo opened the Kagoshima Space Center.
1964	Apr. 1	The Institute of Space and Aeronautical Science, University of Tokyo, was established.
	July 1	The National Space Development Center (NSDC) was organized within STA.
	July 11	University of Tokyo launched the L(La-)-Jeep-3 rocket to an altitude of 850 km.
	Aug. 20	The international agreements for interim arrangements for INTELSAT entered into force.
	Oct. 10	The Tokyo Olympic Games were televised throughout the world via the U.S. communications satellite "SYNCOM-3."
1965	June 20	University of Tokyo announced a plan for scientific satellites.
	Nov. 26	France launched her first satellite "A-1" by the Diamant launch vehicle.
1967	Oct. 10	Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, entered into force.
1968	Aug. 16	The Space Activities Commission (SAC) was established to replace NSAC.

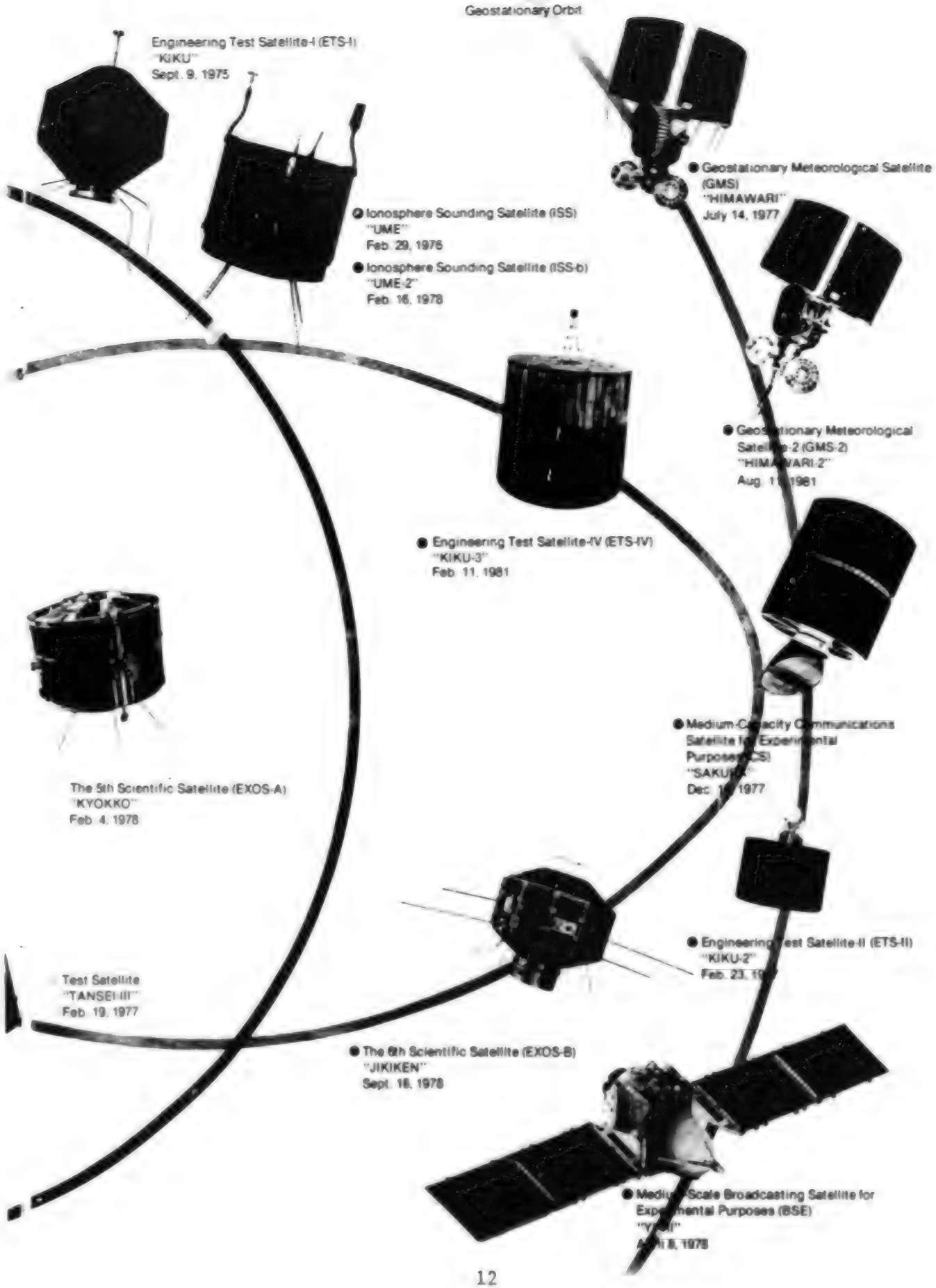
1969	Feb. 6	STA conducted a flight test of the LS-C-1 rocket.
	July 16	The U.S. launched the world's first manned lunar landing spaceship "APOLLO-11" (successfully soft-landed on the moon's surface on July 20).
	July 31	The 1969 U.S.-Japan space agreement was concluded.
	Sept.	STA conducted a flight test of the solid-fuel rocket JCR-1.
	Oct. 1	The National Space Development Agency of Japan (NASDA) was established (NSDC was dissolved).
1970	Feb. 11	University of Tokyo launched the first Japanese satellite "OHSUMI" by the L-4S-5 launch vehicle.
	Apr. 24	The China launched her first satellite.
1971	Feb. 16	The test satellite "TANSEI" was launched.
	Sept. 28	The first Japanese scientific satellite "SHINSEI" was launched.
	Oct. 28	The United Kingdom launched her first satellite "PROSPERO" by the Black Arrow launch vehicle.
1972	Jan. 5	The U.S. decided to develop the Space Shuttle.
	June 1	NASDA set up the Tsukuba Space Center.
	Aug. 19	The second scientific satellite "DENPA" was launched.
1974	Feb. 16	The test satellite "TANSEI-II" was launched.
1975	Feb. 24	The third scientific satellite "TAIYO" was launched.
	Sept. 9	NASDA launched Engineering Test Satellite "KIKU" by the first N-I launch vehicle.
1976	Feb. 29	Ionosphere Sounding Satellite "UME" was launched.
1977	Feb. 19	The test satellite "TANSEI-III" was launched.
	Feb. 23	Engineering Test Satellite "KIKU-2" was launched as the first Japanese geostationary satellite.
	July 14	Geostationary Meteorological Satellite "HIMAWARI" was launched by the U.S. Delta launch vehicle.
	Dec. 15	Medium-Capacity Communications Satellite for Experimental Purposes "SAKURA" was launched by the U.S. Delta launch vehicle.
1978	Feb. 4	The fifth scientific satellite "KYOKKO" was launched.
	Feb. 16	Ionosphere Sounding Satellite "UME-2" was launched.
	Mar. 17	SAC decided "Outline of Japan's Space Development Policy."
	Apr. 8	Medium-Scale Broadcasting Satellite for Experimental Purposes "YURI" was launched by the U.S. Delta launch vehicle.
	Sept. 16	The sixth scientific satellite "JIKIKEN" was launched.
1979	Jan. 29	NASDA concluded Memorandum of Understanding with NASA concerning direct reception of data from Landsat satellites.
	Feb. 6	Experimental Communications Satellite "AYAME" was launched (Planned geostationary orbit not achieved).
	Feb. 21	The fourth scientific satellite "HAKUCHO" was launched.
	July 16	INMARSAT came into existence.
	July 25	Japan and the U.S. agreed to implement joint projects recommended by the NASA/SAC Study Group.
	Aug. 13	The Telecommunications Satellite Corporation of Japan was inaugurated.
	Dec. 24	The European Space Agency (ESA) launched "ARIANE-VI" satellite by the first Ariane launch vehicle.
1980	Feb. 17	The test satellite "TANSEI-IV" was launched.
	Feb. 22	Experimental Communications Satellite "AYAME-2" was launched (Planned geostationary orbit not achieved).
	July 18	India launched her first satellite "ROHINI" by the SLV-3 launch vehicle.
	Sept. 15-20	The U.N. Seminar on Remote Sensing Applications to Land-Use Planning was held in Tokyo.
	Sept. 21-28	International Astronautical Federation (IAF) held the 31st Congress in Tokyo.
1981	Feb. 11	NASDA launched Engineering Test Satellite-IV "KIKU-3" by the first N-II launch vehicle.
	Feb. 21	The seventh scientific satellite "HINOTORI" was launched.
	Apr. 12	The U.S. launched the First Space Shuttle (successfully returned from its mission on Apr. 14).
	Apr. 14	The Institute of Space and Astronautical Science was inaugurated (through reorganization of the Institute of Space and Aeronautical Science, University of Tokyo).
	Aug. 11	NASDA launched Geostationary Meteorological Satellite-2 "HIMAWARI-2".

4. Space Activities in Japan

(1) Development of Satellites

Japan has successfully launched 21 satellites since 1970. Until fiscal 1985, the country plans to launch 4 scientific satellites and 6 practical application satellites, and to participate in the first Spacelab program by providing a principal investigator and major hardware for the SEPAC (Space Experiments with Particle Accelerators) projects.



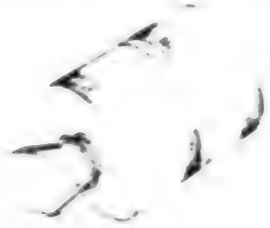

Geostationary Orbit
Engineering Test Satellite-I (ETS-I)
"KIKU"
Sept. 9, 1975
● Ionosphere Sounding Satellite (ISS)
"UME"
Feb. 29, 1976
● Ionosphere Sounding Satellite (ISS-b)
"UME-2"
Feb. 16, 1978
● Geostationary Meteorological Satellite (GMS)
"HIMAWARI"
July 14, 1977
● Geostationary Meteorological Satellite-2 (GMS-2)
"HIMAWARI-2"
Aug. 1[illegible] 1981
● Engineering Test Satellite-IV (ETS-IV)
"KIKU-3"
Feb. 11, 1981
● Medium-Capacity Communications Satellite for Experimental Purposes (CS)
"SAKURA"
Dec. 1[illegible] 1977
The 5th Scientific Satellite (EXOS-A)
"KYOKKO"
Feb. 4, 1978
● Engineering Test Satellite-II (ETS-II)
"KIKU-2"
Feb. 23, 19[illegible]
Test Satellite
"TANSEI-III"
Feb. 19, 1977
● The 6th Scientific Satellite (EXOS-B)
"JIKIKEN"
Sept. 16, 1978
● Medium-Scale Broadcasting Satellite for Experimental Purposes (BSE)
"[illegible]"
[illegible] 8, 1978

Satellites to be Launched in the Future

Engineering Test Satellite-III(ETS-III)

This satellite is intended to carry out tests on three-axis attitude control, solar paddles and active thermal control in order to enhance the development technology common to satellites requiring a large amount of electric power.

Communications Satellite-2(CS-2a,CS-2b)



Designed to relay inter-regional communications in Japan, these satellites will have almost as high capacity as Medium-Capacity Communications Satellite for Experimental Purposes (CS) "SAKURA". They will make it possible to secure communications in case of disaster, maintain communications with remote islands and cope with a temporary increase in the amount of communications. Two satellites of this type, CS-2a, CS-2b will be launched.

Broadcasting Satellite-2(BS-2a, BS-2b)

These satellites will be used for nationwide TV broadcasting. Their performance will be almost comparable to that of Medium-Scale Broadcasting Satellite for Experimental Purposes (BSE) "YURI." The purpose of these satellites is to eliminate poor TV reception areas in Japan, improve reception for urban households subject to reception hindrances, bring TV reception to remote islands and so on. Two satellites of this type, BS-2a, BS-2b will be launched.

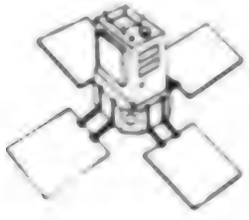
Marine Observation Satellite-1(MOS-1)

This satellite is designed primarily for the observation of oceanic phenomena centering around the surface colors and temperatures of seas. Thanks to information obtained through observation by this satellite, it will become possible to monitor sea contamination, detect current lips and red tide, and survey fishing grounds and currents.

The eighth scientific satellite(ASTRO-B)

This satellite, being prepared to succeed the achievements of the fourth scientific satellite "HAKUCHO", is designed to conduct two-dimensional imaging of celestial X-ray sources such as X-ray nebulae and X-ray galaxies, as well as the observation of X-ray bursters with high temporal and spectrum resolution.

The ninth scientific satellite(EXOS-C)

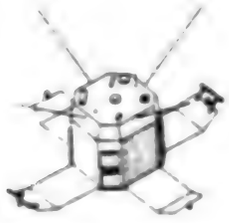


This satellite, being an aeronomy satellite dedicated to participate in the Middle Atmosphere Program (MAP) of ICSU, is designed to observe the phenomena in the stratosphere and the mesosphere (height of 10 to 130 kilometers) with the extensive use of optical means, as well as to clarify the curious behavior of the ionosphere over the South Atlantic Geomegnetic Anomaly which was found by "TAIYO".

The tenth scientific satellite(PLANET-A)

This spacecraft, to be launched into heliocentric orbit, is designed to observe the interplanetary plasma in the inner region of the earth orbit, as well as to take the close-up ultraviolet images of the coma of Halley's comet which approaches the sun in early 1986 after 76-year travel around the sun since its last appearance in 1910. These observations will provide clues to better understanding of the solar wind and the formation of solar system.

The eleventh scientific satellite(ASTRO-C)



This satellite will be built succeeding ASTRO-B for a more comprehensive studies on X-ray astronomy. With its much increased capability in size and weight, ASTRO-C will be able to observe more precisely the behavior of celestial X-ray sources which lie not only in our galaxy but also in the far-away galaxies (several to tens of million light-years) and will contribute to new findings of astrophysical facts which will be taking places in the cosmos.

Space Experiments with Particle Accelerators(SEPAC)

SEPAC will carry out controlled active experiments on the plasma by disturbing it with the injection of charged particles accelerated by the electron and the ion beam accelerators into it to generate aurora-like luminescence, waves, etc., for better understanding of the behavior of the space plasma. SEPAC is being prepared as a joint Japan-U.S. experiment for the Space Shuttle/First Spacelab Mission.

Table of Satellites (a) Application Satellite

Satellites	Main purposes	Weight (kg)	Orbit: Shape	Orbit: Altitude (km)	Orbit: Inclination to equator (degrees)	Launch vehicle	Launch date
Engineering Test Satellite-I (ETS-I) "KIKU"	Confirmation of launching technology, learning of satellite tracking and control technology, test of antenna extension, measuring of satellite environment	82	Circular	880 1,100	47	N-I-1	Sept. 9 1975
Ionosphere Sounding Satellite (ISS) "UME"	Observation of world wide distribution of critical frequencies of ionosphere, world wide distribution of sources of radio noises, etc.	139	Circular	880 1,010	70	N-I-2	Feb. 29 1976
Engineering Test Satellite-II (ETS-II) "KIKU-2"	Learning of technology for putting satellite into geostationary orbit, test of attitude control function, functional test of onboard equipment	130	Geostationary orbit (130 E. Long.)			N-I-3	Feb. 23 1977
Geostationary Meteorological Satellite (GMS) "HIMAWARI"	Participation in the Global Atmospheric Research Program (GARP), photographing of clouds over the Western Pacific and Asian regions, collection and distribution of weather data	315	Geostationary orbit (140 E. Long.)			(U.S.)	July 14 1977
Medium-Capacity Communications Satellite for Experimental Purposes (CS) "SAKURA"	Communications test with quasi-millimeter waves, etc., using satellite system, establishment of technology for operating satellite communications system	340	Geostationary orbit (135 E. Long.)			(U.S.)	Dec. 15 1977
Ionosphere Sounding Satellite (ISS-b) "UME-2"	Same as purposes of (ISS) "UME"	141	Circular	880 1,220	69	N-I-4	Feb. 16 1978
Medium-Scale Broadcasting Satellite for Experimental Purposes (BSE) "YURI"	Transmission test of TV images etc. by satellite system, establishment of technology for operating satellite broadcasting system	350	Geostationary orbit (110 E. Long.)			(U.S.)	Apr. 8 1978
Experimental Communications Satellite (ECS) "AYAME"	Establishment of technology for launching, tracking and controlling communications satellites, communications test with millimeter waves	130	Planned geostationary orbit not achieved			N-I-5	Feb. 6 1979
Experimental Communications Satellite (ECS-b) "AYAME-2"	Same as purposes of (ECS) "AYAME"	130	Planned geostationary orbit not achieved			N-I-6	Feb. 22 1980
Engineering Test Satellite-(V) (ETS-(V)) "KIKU-3"	Confirmation of launching performance of N-II launch vehicle, functional test of space equipment	638	Highly elliptic	220 36,520	29	N-II-1	Feb. 11 1981
Geostationary Meteorological Satellite-2 (GMS-2) "HIMAWARI-2"	Development of technology related to meteorological satellite, improvement of meteorological service	290	Geostationary orbit (140 E. Long.) (Checkout station 180 E. Long.)			N-II-2	Aug. 11 1981

	Satellites	Main purposes	Weight (kg)	Orbit			Launch vehicle	Launch date
				Shape	Altitude (km)	Inclination to equator (degrees)		
(a) Practical Use	Engineering Test Satellite-III (ETS-III)	Development of technology common to satellites requiring high electric power, functional test of space equipment	385	Circular	1 200	45	N-II-7	FY 1982
	Communications Satellite-2 (CS-2a, CS-2b)	Development of communications satellite technology, response to communications demand	350	Geostationary orbit (136 E. Long.)			N-II-3 N-II-4	FY 1982 (CS-2a) FY 1983 (CS-2b)
	Broadcasting Satellite-2 (BS-2a, BS-2b)	Development of broadcasting satellite technology, elimination of poor TV reception areas	350	Geostationary orbit (110 E. Long.)			N-II-5 N-II-6	FY 1983 (BS-2a) FY 1985 (BS-2b)
	Marine Observation Satellite-1 (MOS-1)	Establishment of technology common to earth observation satellites, observation of oceanic phenomena centering on color and temperature of ocean surface	750	Sun-synchronous orbit			N-II-7	FY 1984

(b) Scientific Satellites

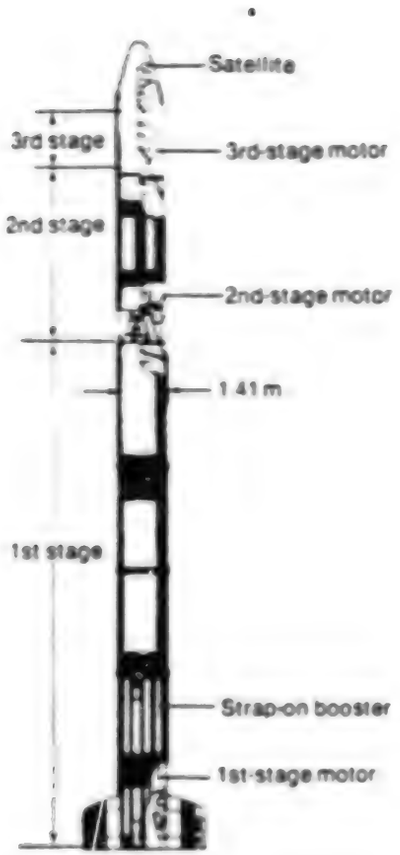
	Satellites	Main purposes	Weight (kg)	Orbit			Launch vehicle	Launch date
				Shape	Altitude (km)	Inclination to equator (degrees)		
(a) Launch Proved	OHSUMI	Learning of satellite launching technology and engineering test of satellite	24	Elliptic	350 5 140	31	L-4S-5	Feb. 11 1970
	Test Satellite (MS-T1) "TANSEI"	Test of satellite environment and functions after entry into orbit	63	Circular	990 1 110	30	M-4S-2	Feb. 16 1971
	The First Scientific Satellite (MS-F2) "SHINSEI"	Observation of ionosphere, cosmic rays, solar and radio emissions, etc	66	Elliptic	870 1 870	32	M-4S-3	Sept. 28 1971
	The Second Scientific Satellite (REXS) "DENPA	Observation of plasma waves, plasma density, electron flux electromagnetic waves geomagnetism, etc	75	Elliptic	290 6 570	31	M-4S-4	Aug. 19 1972
	Test Satellite (MS-T2) "TANSEI-II"	Measuring of launch vehicle performance, engineering test of satellite	58	Elliptic	290 3 240	31	M-3C-1	Feb. 16 1974
	The Third Scientific Satellite SRATS) "TAIYO"	Observation of solar soft X-rays, solar vacuum ultraviolet radiations, geocoronal ultraviolet rays, ionosphere, etc	86	Elliptic	250 3 140	32	M-3C-2	Feb. 24 1975
	Test Satellite (MS-T3) "TANSEI-III"	Measuring of launch vehicle performance, engineering test of satellite	129	Elliptic	750 3 810	66	M-3H-1	Feb. 19 1977
	The Fifth Scientific Satellite (EXOS-A) "KYOKKO"	Observation of plasma density, temperature and composition, spectrum of electron energy, geocoronal distribution, etc., snapshots of ultraviolet aurora image	126	Elliptic	830 3 970	65	M-3H-2	Feb. 4 1978
	The Sixth Scientific Satellite (EXOS-B) "JIKIKEN"	Observation of electron density, particle rays, plasma waves, wave-particle interaction, etc	95	Highly elliptic	220 20 100	31	M-3H-3	Sept. 16 1978

	Satellites	Main purposes	Weight (kg)	Orbit			Launch vehicle	Launch date
				Shape	Altitude (km)	Inclination to equator (degrees)		
Launched	The Fourth Scientific Satellite (CORSA-b) "HAKUCHO"	Observation of X-ray stars, X-ray bursters, very soft X-ray nebulae, etc.	96	Near circular	550 580	30	M-3C-4	Feb. 21, 1979
	Test Satellite (MS-T4) "TANSEI-IV"	Measuring of launch vehicle performance, engineering test of satellite	185	Near circular	520 610	39	M-3S-1	Feb. 17, 1980
	The Seventh Scientific Satellite (ASTRO-A) "HINOTORI"	Observation of two-dimensional hard X-ray image of solar flares, solar particle rays, etc.	188	Near circular	580 640	31	M-3S-2	Feb. 21, 1981
Scheduled	The Eighth Scientific Satellite (ASTRO-B)	Observation of X-ray stars, X-ray galaxies, gamma ray burst, soft X-ray nebulae, etc.	180	Elliptic	350 600	31	M-3S-3	FY 1982
	The Ninth Scientific Satellite (EXOS-C)	Research on upper atmosphere including the stratosphere and mesosphere, etc.	200	Elliptic	300 1,000	65	M-3S-4	FY 1983
	The Tenth Scientific Satellite (PLANET-A)	Research on interplanetary space plasma, observation of Halley's comet by ultraviolet imaging	125	Heliocentric orbit			M-3S mod. I	FY 1984
	The Eleventh Scientific Satellite (ASTRO-C)	Observation of X-ray sources in central core of active galaxies, detailed observation of various X-ray celestial bodies	400	Circular	500 500		M-3S mod. I	FY 1985
	Space Experiments with Particle Accelerators (SEPAC)	Clarification of luminous mechanism of auroras, studies on particle-wave interactions in space plasmas, etc.	Participate in the first Spacelab Mission					FY 1983

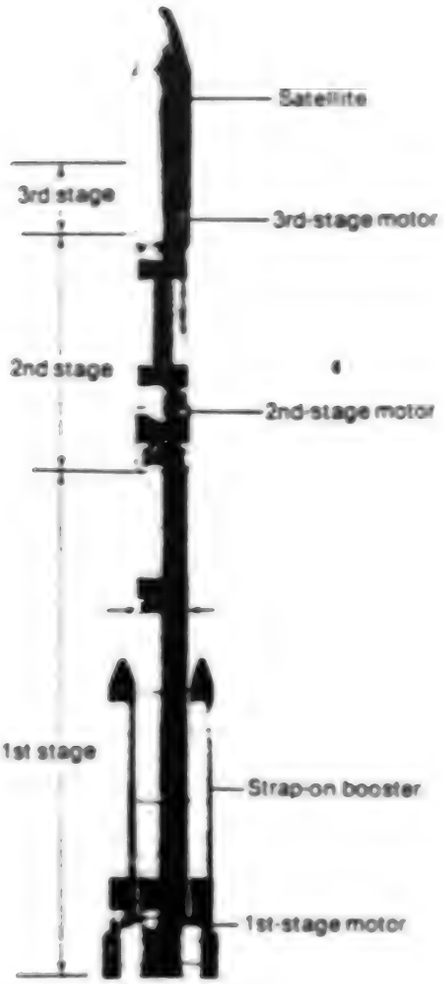
(2) Development of Launch Vehicles

At present, Japan's launch vehicles for satellites consist of the M(Mu)-family launch vehicles for scientific satellites, developed by the Institute of Space and Astronautical Science, and the N-I and N-II launch vehicles of the National Space Development Agency of Japan (NASDA) for satellites designed for practical applications. NASDA is now developing the H-I launch vehicle of higher performance to meet a demand for launching larger satellites expected from the latter half of the 1980s.

a. M Launch Vehicles



M-3S



M-3S mod. I

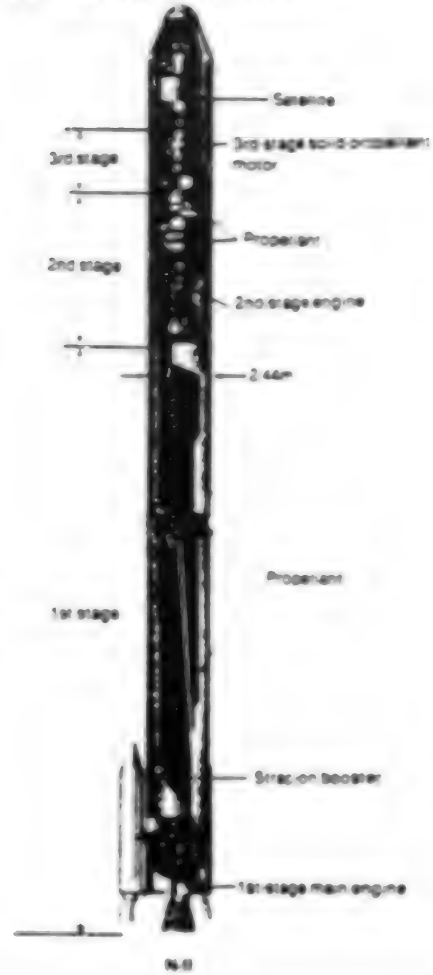
Overall length		23.8m	about 28m
Total weight		49.5t	about 61t
No. of stages		3	3
Propellant	1st stage	Solid	Solid
	2nd stage	Solid	Solid
	3rd stage	Solid	Solid

The M-3S launch vehicle is a three-stage solid-propellant vehicle capable of launching a scientific satellite weighing about 300 kilograms into low-altitude orbit. It has a full guidance and control capability by means of secondary fluid injection thrust vector control systems. In February 1981, this vehicle succeeded in the launch of the seventh scientific satellite "HINOTORI". It is to be used for launching the eighth scientific satellite ASTRO-B and the ninth, EXOS-C.

The M-3S mod. I launch vehicle, improved version of the M-3S launch vehicle, is a three-stage solid-propellant vehicle and provides a capability of orbiting a scientific satellite weighing about 670 kilograms into low-altitude orbit, through the thrust augmentation of the second and the third stage motors and the strap-on boosters. Development of this vehicle is being carried out for launching scientific satellites such as the tenth scientific satellite "PLANET-A".

b. N-I Launch Vehicle

c. N-II Launch Vehicle



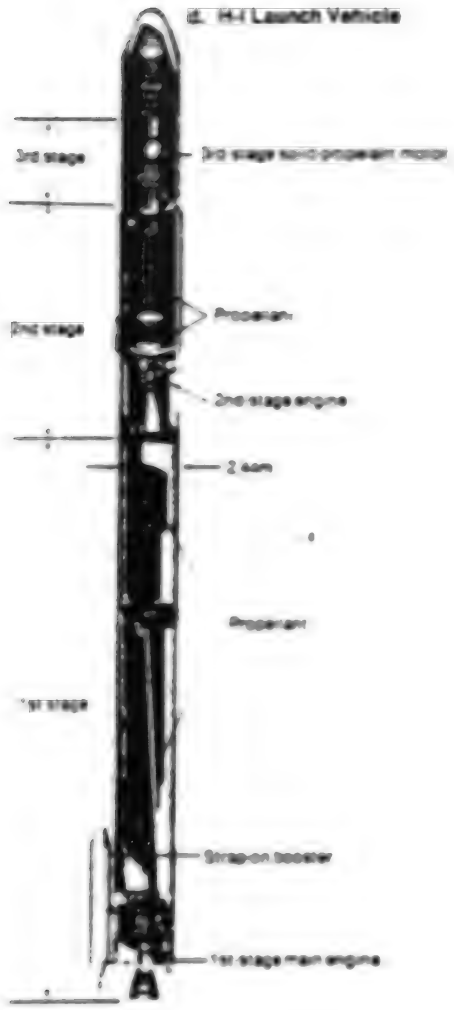
Overall length		32.6m	35.4m
Total weight		90.4t*	134.7t*
No. of stages		3	3
Propellant	1st stage	Liquid	Liquid
	2nd stage	Liquid	Liquid
	3rd stage	Solid	Solid

* Except the satellite and attach fitting

The N-I launch vehicle is a three-stage vehicle capable of launching a satellite weighing about 130 kilograms into geostationary orbit. Liquid-propellant is used for the first and second stages and solid-propellant for the third stage. Six vehicles of this type have already been used since the first one launched Engineering Test Satellite-I "KIKU" in September 1975. The N-I launch vehicle has played a main role in Japan's launching of satellites for practical application. Its development is to end with the launching of Engineering Test Satellite-III (ETS-III) scheduled for fiscal 1982.

The N-II launch vehicle is a three-stage vehicle capable of lifting a geostationary satellite weighing about 350 kilograms. It represents an improved version of the N-I launch vehicle, featuring increased lifting capacity and adoption of the inertial guidance system. The N-II launch vehicle successfully launched Engineering Test Satellite-IV "KIKU-3" in February 1981 and Geostationary Meteorological Satellite-2 "HIMAWARI-2" in August 1981. This vehicle is also scheduled to lift a series of satellites closely bearing on the people's life from fiscal 1982 onward, such as Communications Satellite-2 and Broadcasting Satellite-2.

d. H-I Launch Vehicle



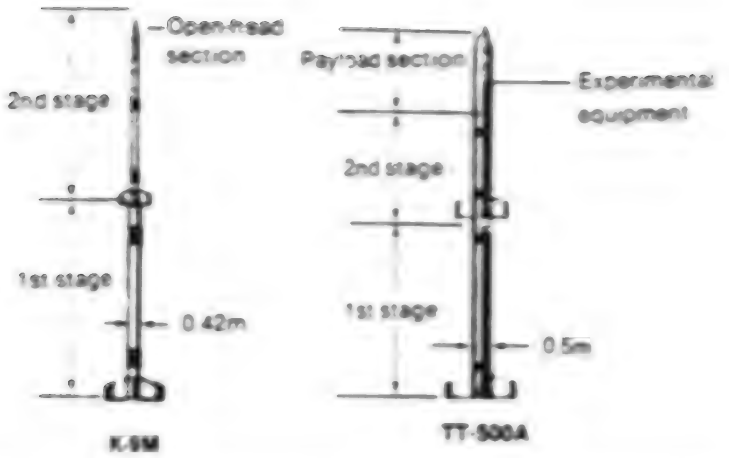
H-I

Overall length		about 40m
Total weight		about 140t*
No. of stages		3
Propellant	1st stage	Liquid
	2nd stage	Liquid**
	3rd stage	Solid

** Liquid hydrogen, liquid oxygen

The H-I launch vehicle is initially being developed as a three-stage vehicle capable of launching a geostationary satellite with a weight of about 550 kilograms. This vehicle, designed to meet an age of large-sized satellites expected from the latter half of the 1990s, will use the first stage of the N-II launch vehicle for the first stage, an engine using liquid oxygen and liquid hydrogen as propellant for the second stage and a large-sized solid-propellant motor for the third stage. Besides, an inertial guidance system using a built-in computer will be adopted for controlling attitude and orbit.

e. Small Rockets



K-9M TT-500A

	K-9M	TT-500A
Overall length	11.1m	10.5m
Total weight	1.5t	2.4t
No. of stages	2	2
Propellant 1st stage	Solid	Solid
Propellant 2nd stage	Solid	Solid
Propellant 3rd stage	—	—

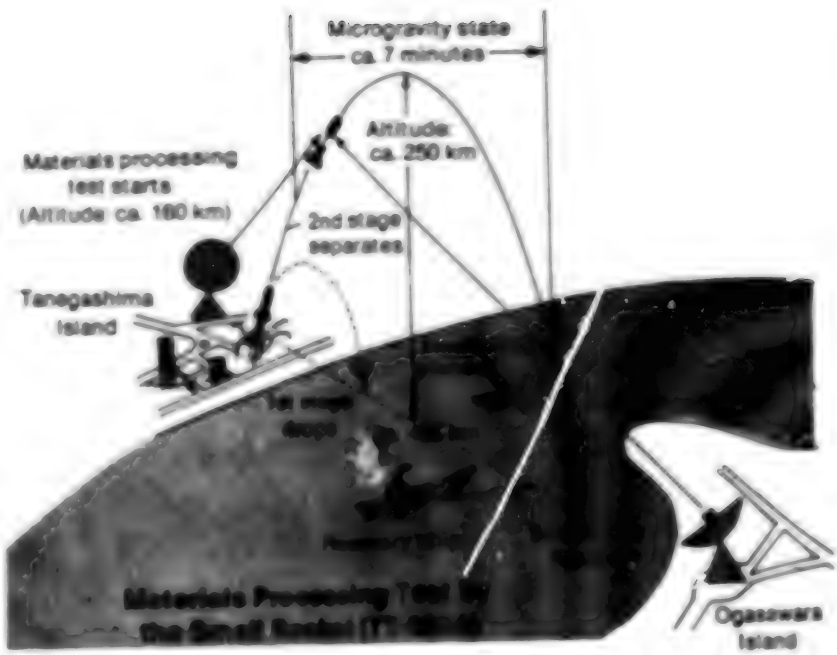
The sounding rockets are small-sized rockets to be launched to altitudes ranging from 70 to 2,000 kilometers above the earth for researches on aeronomy, magnetospheric plasma, astronomy and astrophysics, etc. They consist of S, K and L types. Of these, the K-9M type is most frequently used at present.

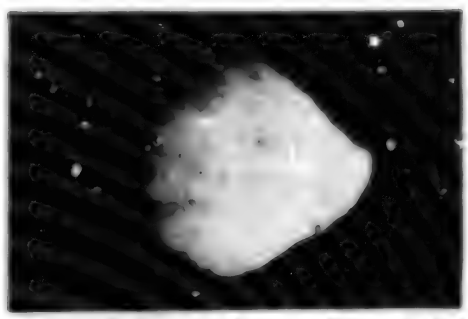
The TT-500A rocket is a two-stage solid-propellant small rocket. It is designed for a test to check the functional coordination between the Tanegashima Space Center and the Ogasawara Down-range Station. Moreover, experimental equipment is installed in the payload section for small-scale materials processing test by taking advantage of a microgravity state lasting for about seven minutes during flight.

(3) Materials Processing in Space

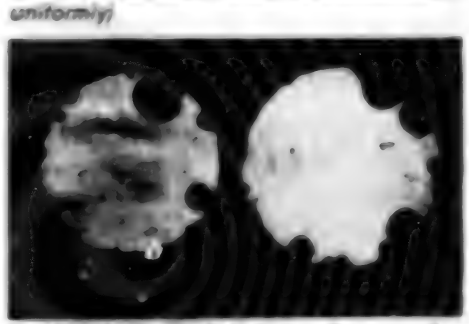
Space has environmental characteristics unavailable on the earth, such as microgravity, high vacuum and intense solar energy, which may be effectively utilized for manufacturing compound alloys, semiconductors, medicines etc. superior to those produced on the earth.

Therefore, Japan is also preparing for materials processing tests in space by using the Space Shuttle. As part of this preparation, materials processing tests are conducted by creating a temporary state of microgravity during the trajectory flight of the small rocket TT-500A.





Semiconductor made in space (intermingled uniformly)



Semiconductor made in test on the ground

(4) Remote Sensing

The National Space Development Agency of Japan (NASDA) receives and processes the data from NASA Landsat-2 and 3.

Besides, development of the first remote sensing satellite (MOS-1) is continued, aiming at launching it in FY 1984. (See page 8 and 12)

In addition, research is being carried out on observation technology and information processing technology by Visible and Thermal Infrared Radiometer and Synthetic Aperture Radar, etc. These technologies will be applied in marine observation, resource exploration, land observation, agriculture, forestry, fisheries, environmental protection, prevention of natural calamities, surveillance of coastal regions, etc. Research is also being carried out on application technology in various fields of utilization such as information analysis technology for exploring resources.

5. International Cooperation

Japan is positively promoting international cooperation in space activities with a view to efficiently carrying out its space development projects and promoting international friendship.

(1) Cooperation with U.S.

Japan and the United States are conducting 17 joint projects under an agreement concluded between Japan's Space Activities Commission (SAC) and the National Aeronautics and Space Administration (NASA) of the United States. Among the projects are the collaborative study of Halley's comet, study of ocean dynamics, measurement of cloud height by satellite stereography, and VLBI experiments for studying crustal plate motions.

(2) Cooperation with ESA

A regular consultation is held annually with the European Space Agency (ESA) in accordance with official notes exchanged in 1972. Information is exchanged on such matters as remote sensing, communications satellites and tracking. The possibility of cooperation is also discussed.

(3) Cooperation with Canada

Japan and Canada are cooperating mainly in the field of remote sensing under an agreement reached at their consultation on science and technology held in 1978.

(4) Cooperation with ESCAP Nations

The Japan Meteorological Agency is directly transmitting cloud pictures, obtained from Geostationary Meteorological Satellite (GMS), to the 13 member nations of the U.N.

Economic and Social Commission for Asia and the Pacific (ESCAP) via the satellite.

Moreover, the Japan International Cooperation Agency (JICA) annually holds training courses on satellite communications and remote sensing data analysis.

In September 1980, Japan held a seminar on remote sensing applications to land-use planning for the ESCAP nations jointly with the United Nations.

(5) Cooperation with U.N.

In the United Nations, Japan has joined the Committee on the Peaceful Uses of Outer Space (COPUOS), positively taking part in debate at COPUOS, its Legal Sub-Committee and Scientific and Technical Sub-Committee.

Meanwhile, Japan is preparing to participate in the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space, called "UNISPACE 82".

In addition, Japan is engaged in positive space-related activities as members of such specialized agencies of the United Nations as the International Telecommunication Union (ITU), the Inter-Governmental Maritime Consultative Organization (IMCO), the International Civil Aviation Organization (ICAO) and the World Meteorological Organization (WMO).

(6) Other Cooperation

Japan is taking positive part in the activities of the International Telecommunications Satellite Organization (INTELSAT) and the International Maritime Satellite Organization (INMARSAT) as members of them.

6. Industry's Role in Space Research

KEIDANREN

Keidanren (Federation of Economic Organizations; Chairman: Yoshihiro Inayama) is a private, non-profit-making economic organization representing all branches of economic activities in Japan. In maintaining close contact with various industrial and financial sectors both at home and abroad, it endeavors not only to find practical solutions to economic problems but also to contribute to the sound development of the economies of Japan and countries around the world.

Keidanren was established in August 1946 through the merger of several economic and industrial organizations active since prewar days.

Since then Keidanren has grown into a nation-wide body with 110 associated and 807 corporate members as of 1981.

Headed by internationally acknowledged leaders of the Japanese business community, Keidanren plays an active and influential role in the achievement of harmonious economic prosperity for all mankind.

Keidanren building

Space Activities Promotion Council

Keidanren's space development activities, dating back to 1961, are now conducted under the Space Activities Promotion Council, established on June 10, 1968.

The primary objectives of the council are:

(1) to review the current space development system in Japan;

(2) to improve indigenous technological development capability and to promote domestic production;

(3) to further international cooperation both with advanced and with developing countries.

Toward these objectives the council maintains close cooperation with the government in the formulation of space development projects and endeavors to achieve national consensus on space development activities.

This independent, private and non-profit-making council is made up of 58 companies and professional trade associations engaged in space activities as of 1981.

Officers

Chairman: Koji Kobayashi
(Chairman, Nippon Electric Co., Ltd.)

Vice Chairmen: Gakuji Moriya
(Counselor, Mitsubishi Heavy Industries, Ltd.)
Shoichi Saba
(President and Representative Director, Toshiba Corporation)

Publication

1. "Uchu." This biannual bulletin describes space development activities of current interest both in Japan and the rest of the world. Distribution of this Japanese booklet is limited to members.
2. "Uchu Kaihatsu Handbook." This handy book in Japanese is published biennially to explain all aspects of the current phase of and future development of Japanese space activities including cooperation with foreign countries. Price per copy is ¥3,200
3. "Space in Japan." This biennial English pamphlet introduces Japanese space activities. Distribution is free for overseas readers.

Secretariat

Director General:	Hiroshi Morikawa
Address:	9-4, Ohtemachi 1-chome, Chiyoda-ku, Tokyo, Japan
Postal Code:	100
Telephone:	Tokyo (03) 279-1411
Telex:	0222-3188 KDRTOK J
Cable:	KDANREN TOKYO

Profile of Members (in alphabetical order)

1 Name of company
2 Name of president
3 Address
4 Telephone number and TELEX number
5 Main space development-related products (or items handled)
6 Name of office in charge of space development
7 Name of manager of office in charge of space development

1. C. Itoh & Co., Ltd.
2. Seiki Tozaki
3. 5-1, Kita-Aoyama 2-chome, Minato-ku, Tokyo
4. Telephone: (03) 497-2240
   Telex: 242-5631
5. Satellite Attitude Control Equipment
   Three-Axis Motion Simulator
   Electro Optical Tracking System
   Electro Optical Instrumentation
   TWT
6. Aircraft Department
   Industrial Electronics Department

7. Kozo Nakamura
   Deputy Manager, Aircraft Department
   Shinichiro Nezu
   Manager, Aircraft Section No. 2
   Shigeru Miyakawa
   Deputy Manager, Industrial Electronics Department

1. **Daicel Chemical Industries, Ltd.**
2. Yoshifumi Kubota
3. Toranomon Mitsui Bldg., 8-1, Kasumigaseki 3-chome, Chiyoda-ku, Tokyo
4. Telephone: (03) 507-3235
   Telex: 222-4632 DAICEL
5. Rocket Motor, Ejection Seat Systems
6. Rocket & Propellant Division
7. Mamoru Ohya
   General Manager

1. **Daido Oxygen Co., Ltd.**
2. Kazuo Yamada
3. 72-1, Unagidani-Nakano-cho, Minami-ku, Osaka
4. Telephone: (06) 252-1381
   Telex: 522-9149
5. Cryogenic Equipments such as storage tank, tank lorry, pump and test stand for liquefied hydrogen
6. (1) East Side Sales Division
   (2) Chemical Machinery & Equipment Dept.
   (3) Quality Control Dept.
7. Takashi Ito
   Director and General Manager
   Soichi Tsuchida
   General Manager
   Hisao Shinkawa
   General Manager

1. **The Dai-Ichi Kangyo Bank, Ltd.**
2. Shuzo Muramoto
3. 1-5, Uchisaiwaicho 1-chome, Chiyoda-ku, Tokyo
4. Telephone: (03) 596-1111
   Telex: J22315

1. **The Fuji Bank, Ltd.**
2. Yoshiro Araki
3. 1-5-5 Otemachi, Chiyoda-ku, Tokyo
4. Telephone: (03) 216-2211
   Telex: J24311, J22722, J22367, J22170, J22171

1. Fujitsu Limited
2. Takuma Yamamoto
3. 6-1, Marunouchi 2-chome, Chiyoda-ku, Tokyo
4. Telephone: (03) 216-3211
   Telex: J 22833
5. Electronics for Space Use
   Ground Signal Processing System
6. Radio Division
7. Jinjiro Dodo
   General Manager

1. Hitachi, Ltd.
2. Katsushige Mita
3. 5-1, Marunouchi 1-chome, Chiyoda-ku, Tokyo
4. Telephone: (03) 212-1111
   Telex: J22395, J22432, J23391, J26375 (HITACHY)
5. Planning & Promotion for the Space Business
   (1) Earth Station for Earth Observation Satellite (Recording System)
   (2) Satellite Laser Tracking System
   (3) Satellite/Rocket-borne Measuring Equipment
   (4) Magnetic Posture Controller
   (5) Earth Station for Earth Observation Satellite (Image Data Processing & Product Generation System)
   (6) ditto (Information Retrieval System)
   (7) ditto (Products Evaluating System)
   (8) Image Analysis System for Earth Observation Satellite
   (9) Large Size Space Simulation Chamber
   (10) Thermal Evaluation Test Stand
6. Space Systems Division, Systems Engineering Dept. 1, Systems Engineering Division Space Technology Group, Advanced Development Department, Telecommunications Division
   Space Technology Group, Electrical & Control Systems Division, Industrial Processes Group
   Chemical Plant & Equipment Dept., Plant Engineering Division, Industrial Processes Group
7. Takao Moriya, Department Manager
   Shizue Kariya, Department Manager
   Yukio Hasegawa, Department Manager, Advanced Development Department
   Mitsuyoshi Kosaka, Department Manager
   Daiya Aoki, Department Manager

1. Ishikawajima-Harima Heavy Industries Co., Ltd.
2. Taiji Ubukata
3. 2-1, Otemachi 2-chome, Chiyoda-ku, Tokyo

4. Telephone: (03) 244-5044
   Telex: TK 2232, TK 4239, TK 2368
5. Rocket Engine, GAS-Jet, Material-Processing, etc.
6. Space Development Division
7. Minoru Hirata
   General Manager of Space Development Division

1. **Iwatsu Electric Co., Ltd.**
2. Shinji Hayashi
3. 7-41, Kugayama 1-chome, Suginami-ku, Tokyo
4. Telephone: (03) 334-1111
   Telex: J24225 (TELEIWA)
5. Measuring System of Rocket Engine Test Facility
   N-Rocket Ordnance Automatic Test System
6. Development Section, Electronic Measuring Instruments Department
7. Nobuaki Iijima
   Manager, Development Section
   Tadayoshi Onobayashi
   (Development Section)
   Molio Sato
   (Development Section)

1. **Japan Aircraft Mfg. Co., Ltd.**
2. Ritsuo Nakagawa
3. 3175, Showa-machi, Kanazawa-ku, Yokohama
4. Telephone: (045) 771-1251
   Telex: (3822) 267 NIPPIJ
5. Rockets (tail fuselages and fins), Satellites
6. Engineering Div., Rocket-Target Team
7. Masaru Sakamaki
   Section Chief, Engineering Div
   Taketo Kosuda
   Section Chief, Engineering Div
   Yoshiaki Kakitsubo
   Section Chief in Charge of Rockets & Satellites, Engineering Div

1. **Japan Aviation Electronics Industry, Ltd.**
2. Shinichi Uematsu
3. 21-6, Dogenzaka 1-chome, Shibuya-ku, Tokyo
4. Telephone: (03) 463-3111
   Telex: 242-3345 JAEJ
5. (1) Inertial Guidance System
   (2) Propellant Level Measurement Unit
   (3) Inertial Sensor
   (4) Inertial Attitude Reference Unit for Rocket
6. Aerospace Division
7. Chiaki Akita
   General Manager

1. **Japan Broadcasting Corporation**
2. Tomokazu Sakamoto
3. 2-2-1, Jinnan, Shibuya-ku, Tokyo
4. Telephone: (03) 465-1111
   Telex: RADIONHK J22377
5. Broadcasting Satellite Service
6. Engineering Headquarters
7. Ryo Takahashi
   Director General of Engineering
   Koichi Yabashi
   Director General, Engineering Headquarters

1. **Japan Propellent Industry Co., Ltd.**
2. Masao Akatsu
3. 23-10, Akatsuka 3-chome, Itabashi-ku, Tokyo
4. Telephone: (03) 939-3920
5. Arrangements to treat exhaust gas and drainage, cleaning facilities, cleaning room and analysis of propellant
6. Technical Department
7. Takahiro Akatsu
   Controller and Manager of Technical Department

1. **Japan Radio Company Ltd.**
2. Koji Matsui
3. No. 5 Mori Bldg., 1-17-1, Toranomon, Minato-ku, Tokyo
4. Telephone: (03) 591-3451
   Telex: 222-3068
5. Ship Earth Station
6. Research and Development
7. Katsumi Tsujimura
   Manager

1. **Kawasaki Heavy Industries, Ltd.**
2. Kenko Hasegawa
3. 4-1, Hamamatsu-cho 2-chome, Minato-ku, Tokyo
4. Telephone: (03) 435-2971
   Telex: (NTT) 242-4371
5. Ground Facility Equipments, Soft Ware, Satellite, Vehicle
6. Aerospace Engineering Development Department
7. Tadashi Ono
   Senior Manager

1. **Kokusai Denshin Denwa Co., Ltd.**
2. Motoichi Masuda
3. 3-2, Nishishinjuku 2-chome, Shinjuku-ku, Tokyo
4. Telephone: (03) 347-7531
   Telex: 122500

1. Kokusai Electric Co., Ltd.
2. Noboru Nakamura
3. 22-15, Toranomon 1-chome, Minato-ku, Tokyo
4. Telephone: (03) 591-8371
   Telex: 222-3277
5. Command, Transmitter
6. Government Equipment Sales Dept
7. Hitoshi Takemoto
   Manager

1. Kyokuto Boeki Kaisha, Ltd.
2. Kyugo Miyoshi
3. 2-1, Otemachi 2-chome, Chiyoda-ku, Tokyo
4. Telephone: (03) 244-3701, (03) 244-3711
   Telex: KYOKUBO J22440, 22584 and 22405
5. Rocket Test Stand
   Test Equipment for Gyros and Accelerometers
   Pressure Transducers and Accelerometers
6. Special Machinery Dept
7. Kenji Kusayanagi
   Manager, Special Machinery Dept
   Hiroyuki Endo
   Chief, Electronic Equipment Section

1. The Kyowa Bank, Ltd.
2. Tetsuo Yamanaka
3. 1-2, Otemachi 1-chome, Chiyoda-ku, Tokyo
4. Telephone: (03) 287-2111

1. Kyushu Electrical Construction, Ltd.
2. Katsutoshi Hiraki
3. 23-35, Nanokawa 1-chome, Minami-ku, Fukuoka City
4. Telephone: (092) 523-1231
   Telex: 726-226 KYUKO J
5. Installations of Electrical Facilities, Air-conditioning and Plumbing, Water Treatment and Communication
6. Tokyo Business Dept., Business Headquarters
   Business Section, Kagoshima Branch
   Tanegashima Rocket Base Construction Office
7. Takeo Kanagawa
   Manager, Tokyo Business Dept., Business Hq.
   Tetsuzo Koga
   Chief, Business Sect., Kagoshima Branch
   Masahiro Fujimoto
   Site Manager, T.R.B. Construction Office

1. The Long-Term Credit Bank of Japan, Ltd.
2. Kanbei Yoshimura
3. 2-4, Otemachi 1-chome, Chiyoda-ku, Tokyo
4. Telephone: (03) 211 5111

1. Marubeni Corporation
2. Matsujiro Ikeda
3. 4-2, Ohtemachi 1-chome, Chiyoda-ku, Tokyo
4. Telephone: (03) 282-3330
   Telex: J22526, J22328
5. LANDSAT Ground Terminal System etc.
6. (1) Aerospace Equipment Section, Transport Equipment Dept.
   (2) Aerospace Development Section, Transport Equipment Dept.
7. Toyoyasu Kobatake
   General Manager, Transport Equipment Dept.
   Takashi Katoh
   Assistant General Manager, Transport Equipment Dept.
   Kuniyoshi Inoshita
   Assistant General Manager, Transport Equipment Dept.
   Yoshiaki Ishimori
   General Manager, Aerospace Development Section, Transport Equipment Dept.

1. Matsushita Communication Industrial Co., Ltd.
2. Akisada Ogama
3. 3-1, Tsunashima-Higashi 4-chome, Kohoku-ku, Yokohama
4. (045) 531-1231
   Telex: 3822-671
5. Measuring instruments, Timers, Telemeters, Rocket Launching Control System, etc.
6. Radio Telecommunication Division
7. Tatsuo Yoshiyama
   Director

1. Meisei Electric Co., Ltd.
2. Chikanao Urakawa, President
3. 5-7, Koishikawa 2-chome, Bunkyo-ku, Tokyo
4. Telephone: (03) 814-5111
   Telex: 272-2152
5. Radar Transponder, Spacelab Device for Space-Shuttle, Electro Density Measuring Device
6. No. 3 Sales Sec., Electronic Appliance Sales Dept.
7. Nobuo Takabatake, Ass't Manager
   Katsumasa Yokoyama, Ass't Manager

1. Mitsubishi Corporation
2. Yoohei Mimura
3. 6-5 Marunouchi 2-chome, Chiyoda-ku, Tokyo
4. Telephone: (03) 210-2121
   Telex: J22222 MITUBISI
5. All Space Related Hardware & Software
   Launch Vehicle Hardware & Software
   Satellite Hardware & Software

Ground Station Hardware & Software
Hardware & Software for Space Shuttle/Spacelab Utilization Programs
Range Safety Operation Software
Other Space Related Activities

6 Aerospace Dept.

7 Kimio Komatsubara, General Manager, Aerospace Dept.

1. **Mitsubishi Electric Corporation**
2. Nihachiro Katayama
3. 2-3, Marunouchi 2-chome, Chiyoda-ku, Tokyo
4. Telephone: (03) 218-2111
   Telex: 222-3484
5. (1) Systems engineering and various kinds of soft ware
   (2) Satellites and satellite-borne equipment
   (3) Rocket-borne equipment
   (4) Control and operational equipment of satellites
   (5) Guidance-control equipment of rockets
   (6) Earth station for space communications
   (7) Various kinds of check-out equipment
6. Space System Department
7. Masahiko Nomura
   Manager, Space System Department

1. **Mitsubishi Heavy Industries, Ltd.**
2. Soichiro Suenaga
3. 5-1, Marunouchi 2-chome, Chiyoda-ku, Tokyo
4. Telephone: (03) 212-3111
   Telex: J2243 HISHIJU
5. (1) N-I, II, H I Rocket
   Manufacturing Vehicles Structures and Engines
   Assembly and System Integration
   (2) Rocket Ground Equipment
   (3) Solid Rocket Chamber
6. Head Office: Space Systems Department
   Nagoya Aircraft Works: Space Systems Department
   Kobe Shipyard & Engine Works: Space Equipment Department
7. H/O: Masahiko Hamada, General Manager, Space Systems Dept
   N/A: Toshio Masurani, Manager, Space Systems Dept.
   K/S: Naruki Ono, Manager, Space Equipment Dept.

1. **Mitsubishi Precision Company, Ltd.**
2. Etsuo Aoyama
3. 345 Kamimachiya, Kamakura, Kanagawa-ken
4. Telephone: (0467) 46-4146
   Telex: 3862120
5. Electronics Equipment for Attitude Control and Guidance Control
6. Space Electronics Equipment Section, Air Navigation Engineering Department

7 Takeshi Hagiwara
Director and General Manager of Marketing

1. Mitsubishi Space Software Co., Ltd.
2. Naomi Yamaki
3. 2-4-1 Hamamatsucho, Minato-ku, Tokyo
4. Telephone: (03) 435-4718
5. System Engineering and Software Development for Space Program
6. Grogram Office Operations Group
Technical Marketing Department
7. Yohdoh Kameo
Manager
Kazuaki Shizuno
Manager

1. Mitsui & Co., Ltd.
2. Toshikuni Yahiro
3. 2-1, Ohtemachi 1-chome, Chiyoda-ku, Tokyo
4. Telephone: (03) 285-1111
Telex: 222-2001, 2002
5. Launching Vehicle, Satellite, Space Shuttle Utilization
6. Aerospace Dept. Aerospace Systems Div.
7. Susumu Kawahara
General Manager, Aerospace Dept.

1. Mitsui Engineering & Shipbuilding Co., Ltd.
2. Kazuo Maeda
3. 6-4, Tsukiji 5-chome, Chuo-ku, Tokyo
4. Telephone: (03) 544-3002
Telex: J 22821, J 22924
5.
6. Technical Research & Development Head Quarters
7. Satoru Ohashi
Director and General Manager
Katsuo Ito
Manager, Developemt Planning Department, Technical Reseach & Development H.Q

1. NAC Incorporated
2. Kennosuke Nakauma, President
3. 1-2-7 Nishi-Azabu, Minato-ku, Tokyo
4. Telephone: (03) 404-2321
Telex: 242-2490/CAMNAC J
5. Flying Object Photo-Instrumentation System
Cinetheodolite Airborne Use Camera
Remote Sensing Image Data Processing System
6. Second Section of Marketing Department
7. Akira Abe
Vice Chief

1. NEC-Honeywell Space Systems, Ltd.
2. Takeshi Kawahashi
3. 7-15, Shiba 5-chome, Minato-ku, Tokyo
4. Telephone: (03) 454-1111
5. System Designs and Analyses for Rocket Guidance Equipment

1. Nippon Electronics Development Co., Ltd.
2. Saburo Matsuo
3. 7-30, Nishi Shinjuku 7-chome, Shinjuku-ku, Tokyo
4. Telephone: (03) 367-5021
   Telex: 2324936 NEDINT J
5. Range Safety Operational Soft
6. Space Development Group
7. Koichiro Tsunoda

1. Nippon Electric Company, Limited (NEC)
2. Tadahiro Sekimoto
3. 33-1, Shiba 5-chome, Minato-ku, Tokyo
4. Telephone: (03) 454-1111
   Telex: NECTOK J22686
5. (1) Satellite: Engineering Test Satellite (ETS-1), Geostationary Meteorological Satellite (GMS) and GMS-2, Marine Observation Satellite-1 (MOS-1), Astronomic Satellite-A (ASTRO-A), etc.
   Satelliteborne Subsystems and Equipments:
   Multispectral Electronic Self Scanning Radiometer (MESSR), On Board Computer (OBC), Telemetry Transmitter (TLM), Command Receiver (CMD), etc.
   Rocketborne Equipments:
   Command Destruct Receiver (CDR), TLM, CMD, etc.
   System Design of Satellite Launching and Mission Operation Support
   Ground Electronic Systems for Rocket and Satellite:
   Launch Operation Control System, Telemetry Tracking and Control System (TT&C), Range and Range Rate Equipment (R&RR), etc.
   (2) INTELSAT Standard A,B,C Earth Stations
   Regional and Domestic Satellite Communications Earth Stations
   Transportable and Mobile Earth Stations
   Optical Communication Equipments
   Onboard Transponders for Communications Satellites for CS, CS-2, ECS, INTELSAT-IV, IVA, etc.
   (3) Rocket Guidance and Control Equipment:
   Inertial Guidance Computer, etc.
   Radio Remote Sensor and Associated Equipments:
   Synthetic Aperture Radar (SAR), Radar Altimeter, etc.
   (4) Radio Navigation and RADAR Equipment
   (5) Components and Electron Devices for Space Equipment:
   IC, LSI, CCD, TWT, etc.

6 Space Development Sales Division
Space Development Division
Microwave and Satellite Communications Division
Satellite Communications Systems Division
Guidance and Electro-Optics Division
Radio Application Division
7 Takeshi Kawahashi, Senior Executive Vice President
Toshihiko Saigo, Senior Vice President
Yukio Kaito, Associate Senior Vice President
Takahiko Tanaka, Vice President (Government Sales)
Masaya Tanaka, Vice President (Radio Group)
Tadao Asano, General Manager, Space Development Sales Division
Takaji Kuroda, General Manager, Space Development Division
Ryoji Tamura, General Manager, Microwave & Satellite Communications Division
Kenji Yoda, General Manager, Satellite Communications Systems Division
Tadashi Furuya, General Manager, Milimeter-wave and Video Communications Development Laboratory
Kenichi Fukuzumi, General Manager, Guidance and Electro-Optics Division
Takeshi Yamauchi, General Manager, Radio Application Division
Haruo Shiki
Yoshiro Takeuchi
Masahisa Miyagi
Chief Engineers, Radio Group

1. Nippon Oil & Fats Co., Ltd.
2 Teruji Ogawa
3 10-1, Yuraku-cho 1-chome, Chiyoda-ku, Tokyo
4 Telephone: (03) 283-7277
Telex: 222-2041
5 Rocket Propellants (Solid)
Electro-Explosive Device
6 Space Rocket Div.
7 Shigeraka Imahuku
Manager

1. Nippon Sanso K.K.
2 Natsuro Ishizawa
3 16-7, Nishi-Shimbashi 1-chome, Minato-ku, Tokyo
4 Telephone: (03) 503-2271
Telex: J24228 NSANSO
5 Cryogenic Rocket Fuels (Liquid Oxygen, Liquid Hydrogen)
Rocket Engine Test Facilities, Space Simulation Chamber
6 2nd Department, Plant and Machinery Division
7 Michihiro Ando
Manager, 2nd Department, Plant and Machinery Division

1. **Nippon Steel Corporation**
2. Yutaka Takeda
3. 6-3, Otemachi 2-chome, Chiyoda-ku, Tokyo
4. Telephone: (03) 242-4111
   Telex: J22291
5. Steel Products
6. R & D Managing Dept., Central R & D Bureau
7. Yasuo Tsukahara
   Manager, R & D Planning & Coordination Section

1. **Nippon Telegraph and Telephone Public Corporation**
2. Hisashi Shinto
3. 1-1-6, Uchisaiwai-cho, Chiyoda-ku, Tokyo
4. Telephone: (03) 509-5111
   Telex: 222-5300
5. Design and Maintenance of Satellite Communication Systems for Public Telecommunication
6. Radio Systems Group, Engineering Bureau
7. Kohei Nishino

1. **Nissan Motor Co., Ltd.**
2. Takashi Ishihara
3. 17-1, Ginza 6-chome, Chuo-ku, Tokyo
4. Telephone: (03) 543-5523
   Telex: J22503, J24474, J24715
5. (1) The Institute of Space and Astronautical Science (ISAS)
   M-3S Satellite Launch Vehicle
   K-9M Sounding Rocket
   K-10 "
   S-210 "
   S-310 "
   S-520 "
   (2) National Space Development Agency of Japan (NASDA
   TT-500A Sounding Rocket
   MT-135P "
   N-1 Strap on Booster Motor (License Production)
   (3) The Japan Meteorological Agency (JMA)
   MT-135P Sounding Rocket
6. Aeronautical and Space Division
   Sales Section No. 1, Sales and Marketing Department
   Sales Section No. 3, Sales and Marketing Department
   Design Section No. 1, Research and Design Department
   Design Section No. 3, Research and Design Department
7. Masataka Okuma, Executive Vice President and Director
   Kazuo Shibata, Director and General Manager, Aeronautical and Space Division
   Yoshihiro Shibuya, Deputy General Manager, Aeronautical and Space Division
   Yoshihiro Shibuya, General Manager, Sales and Marketing Department

Masaharu Hama, Manager, Sales Section No. 1
Michitaka Shiraishi, Manager, Sales Section No. 3
Tadahiko Nagaoka, General Manager, Research and Design Department
Takuji Murakami, Manager, Design Section No. 1
Kazuyoshi Ninomiya, Manager, Design Section No. 3

1. **Nissho Iwai Corporation**
2. Mitsuo Ueda
3. 4-5, Akasaka 2-chome, Minato-ku, Tokyo
4. Telephone: (03) 588-2111
   Telex: J22233
5. LANDSAT, COMSAT and their Ground Support Equipment
6. Aircraft and Advanced Technology Dept.
7. Michihito Iwai
   Manager, Project Office

1. **Oki Electric Industry Company, Ltd.**
2. Masao Miyake
3. 1-7-12, Toranomon, Minato-ku, Tokyo
4. Telephone: (03) 501-3111
   Telex: J22627
5. Command, Control and Communications Systems
6. Engineering Administration Division
7. Jun Jinguji
   Executive Director

1. **Okura and Company, Ltd.**
2. Taketaro Takenaka
3. 3-6, Ginza 2-chome, Chuo-ku, Tokyo
4. Telephone: (03) 563-6111
   Telex: J22306
5. Agent for RCA Asto-Electronics
6. Aerospace Systems Sect., Electronic Aircraft Dept.
7. Hideyo
   General Manager
   Naohiko Takeuchi
   Assistant to General Manager
   Toshiaki Kiuchi
   Manager

1. **Remote Sensing Technology Center of Japan**
2. Koohei Suzue, President
3. Uni Roppongi Bldg., 7-15-17, Roppongi, Minato-ku, Tokyo
4. Telephone: (03) 403-1761

5 (1) Investigation & Research on Remote Sensing Technology
(2) Collection and Distribution of Remote Sensing Data
(3) Training of Personnel on Remote Sensing
(4) Popularization and Education on Remote Sensing
(5) International Cooperation on Remote Sensing

6.7.
Keiji Maruo
Managing Director and General Manager of Planning Dept. & Investigation Dept.
Kenkichi Miyazaki
Director and General Manager of Research Dept.
Hiroshi Ishigami
General Manager, Data Service Dept.

1. The Sanwa Bank Ltd.
2 Toshio Akashi
3 1-1-1, Ohtemachi, Chiyoda-ku, Tokyo
4. Telephone: (03) 216-3111
Telex: J-23320

1. Sharp Corporation
2 Akira Saeki
3. 22-22, Nagaike-cho, Abeno-ku, Osaka
4. Telephone: (06) 621-1221
Telex: 526-7420
5. Solar Cell
6. Engineering Center
7. Tadashi Sasaki
Senior Executive Director

1. The Society of Japanese Aerospace Companies, Inc.
2 Eiichi Ohara, Chairman
3 518 Hibiya Park Bldg., 1-8-1, Yuraku-cho, Chiyoda-ku, Tokyo
4. Telephone: (03) 211-5678
5. Spacecraft and its Launching Vehicles
6 Technical Department
7 Masaaki Iwata
Manager

1. Sumitomo Corporation
2 Mitsuo Uemura
3. 2-2, Hitotsubashi 1-chome, Chiyoda-ku, Tokyo.
4 Telephone: (03) 217-5000
Telex: J22202 SUMITOMO
5 Global Positioning System

6. Aerospace Department
7. Tsuneo Iwasaki
   General Manager Aerospace Dept.

1. **Sumitomo Precision Products Co., Ltd.**
2. Shigeo Yoshii
3. 6, Nishi-Nagasu-Hondori 2-chome, Amagasaki City
4. Telephone: (06) 482-8811
   Telex: SUMITPP OSK 524-5501
5. Lox Heater, Impeller, Injector
6. Engineering & Development Department
7. Shunro Hayashi
   Manager, Engineering and Development Department

1. **System Development Corporation of Japan, Ltd.**
2. Mikito Kono
3. 24-5, Sakuragaoka-cho, Shibuya-ku, Tokyo
4. Telephone: (03) 461-5261
   Telex: (O) 242-3443 SDCJ J
5. (1) System Study
   (2) Soft Ware
   (3) System Integration
   (4) System Design & Development
6. Space Systems Dept.
7. Michio Sakaba
   General Manager

1. **TEISAN K.K. (The company name was changed from former Teikoku Sanso on April 1, 1981).**
2. Michihiko Komatsubara
3. 2-15, 2-chome, Isobe-Dori, Chuo-Ku, Kobe City
4. Tel (078) 251-5941
   TELEX 5622-262 TSKOB J
5. (1) Supply of liquefied gas
   Transport and supply of liquefied gas and vaporized gas
   (Liquefied hydrogen, liquefied helium, liquefied oxygen, liquefied nitrogen and vaporized gases)
   (2) Production of high pressure gas facilities, manufacturing plants and storing/supply facilities
   (Liquefied hydrogen, liquefied helium, liquefied oxygen, liquefied nitrogen, vaporized gases, and RJ-1).
6. (1) a. Gas service headquarters (Kobe head office)
   b. Gas marketing division (Tokyo head office)
   c. Gas sales division (Kobe head office)
   d. Gas sales division (Tokyo head office)

(2) a. Equipment service headquarters (Kobe head office)
b. Equipment group (Tokyo head office)
c. Engineering group (Harima office)
d. Cryo system (Harima office)

7. (1) a. Seiichi Chaya, board director and executive manager
b. Toshio Watanabe, manager, Gas Marketing Division
c. Yasuhiro Urakawa, manager, Gas Sales Division
d. Shigeki Tsuchiike, manager, Gas Sales Section

(2) a. Shiro Ueno, Board Director and Executive Manager
b. Takuji Hanada, Assistant Manager, Equipment Service Headquarters
c. Harumitsu Takagi, Board Director and Assistant Manager, Equipment Service Headquarters
d. Yoshiaki Tanaka, Assistant Manager, Cryo System Division

Remarks: Locations and telephone numbers (TELEX numbers)
a. Kobe head office: Address, telephone number and TELEX number are as given in Clauses 3 and 4
b. Tokyo head office: 15-12 1-chome, Toranomon, Minato-ku, Tokyo (c/o Nihon Gas Kyokai); Tel: (03)-502-0551; TELEX: 2223-190 TSTOKJ
c. Harima sales office: 16 Niijima, Harimacho, Kako-gun, Hyogo-ken; Tel: (0794) 37-2811; TELEX: 5654-515 TSHARJ

1. **Tokyo Aircraft Instrument Co., Ltd.**
2. Shigeo Wada, President
3. 35-1, Izumi-Honcho 1-chome, Komae-shi, Tokyo
4. Telephone: (03) 489-1121
   Telex: 242-2246 TKKWADJ
5. Pressure Switch
6. The 1st Div., The 1st Engineering Dept.
7. Akira Kanai
   General Manager

1. **Toray Industries Inc.**
2. Yoshikazu Ito
3. 2-2, Nihonbashi-Muromachi, Chuo-ku, Tokyo
4. Telephone: (03) 245-5740
   Telex: J22623
5. Carbon Fibre (yarn, fabric, prepreg)
6. Torayca Department
7. Makoto Tatsuhana
   General Manager, Torayca Dept

1. **Toshiba Corporation**
2. Shouchi Saba
   President and Representative Director

3. Principal Office: 1-6, Uchisaiwai-cho 1-chome, Chiyoda-ku, Tokyo.
4. Telephone: (03) 501-5411
   Telex: J22587 TOSHIBA
5. Spacecraft Systems and Spacecraft Components/Parts
   Ground facilities including Control Softwares
6. Space Programs Division
7. Atsushi Kurokawa
   Manager, Programs Planning & Sales Department
   Space Programs Division

1. **Toyo Communication Equipment Co., Ltd.**
2. Yasuo Suzuki
3. 753 Koyato, Samukawamachi, Kozagun, Kanagawa
4. Telephone: 0467-74-1131
   Telex: 3862-133
5. Electronic Ground Equipment for Rocket and Satellite.
   Rocketborne Electric Equipment
   Testing Ground Equipment for Satellite
6. Engineering Dept., Electronic Equipment Div.
   Space Euipment Group, R & D Div.
   Engineering Dept., Radio Communication Div.
7. Yasugi Yamaguchi
   Manager, Engineering Dept., Electronic Equipment Div.
   Sohtaroh Konno
   Manager, Development Dept., R & D Div.
   Masakiyo Tada
   Manager, Engineering Dept., Radio Communication Div.

1. **The Yokohama Rubber Co., Ltd.**
2. Hisaaki Suzuki
3. 36-11, Shinbashi 5-chome, Minato-ku, Tokyo.
4. Telephone: (03) 432-7111
   Telex: J24673 YOKORUCO
5. Duct, Bellows, Tube, Insulation-Blanket, Heat-Exchanger
6. Sales Dept., Aerospace Division
7. Hiroshi Ishikawa
   Director & General Manager, Aerospace Div.
   George Yanagita
   Sales Manager

APPENDIX

The summary of the Outline of Japan's Space Development Policy

1. Basic Principles of Space Development Policy

1) Social needs and available national resources

Japan's space development should be confined to peaceful purposes, should be able to respond fully and effectively to various social needs, and should aim at producing a system which can be used easily in preparation for the day when space is used widely by the public.

Japan should also select from a long-term viewpoint only important issues for space development. Furthermore, in carrying out the various programs, the necessity, urgency and economies of each program should be constantly reviewed so that it can be carried out systematically and effectively in response to circumstances and national resources.

2) Autonomy in space development

Japan has to develop its own technological resources so that it will be able to carry out various space development activities steadily in the future.

3) International cooperation

Japan's own space development will be promoted while maintaining as much cooperation as possible with other such activities around the world. Therefore, when the necessity arises for activities which are beyond Japan's technological capability, such as low deceleration recovery or manned support activities, the Space Shuttle and other means will be utilized in order to advance Japan's space development to an internationally high standard.

2. Priority Goals in Space Activities

1) Japan's scientific research has been making internationally recognized achievements. Emphasis will be placed on keeping Japan's level of science abreast with international standards, on contributing to the intellectual progress of mankind and on promoting the development of science and its application in ways suitable to Japan.

2) In the field of application, efforts will be made to establish technical reliability and stability in the further advancement and application of techniques which have been developed in the area of communications, broadcasting, meteorological observation and ionospheric observation. At the same time, various projects will be promoted concerning navigation, geodesy, ocean observation, the survey of resources and the environment, manufacturing of materials and life

science, making use of the characteristics of space. Programs will also emphasize the reduction of ground work, higher sophistication of satellite missions, simplification of operations and lower costs by means of advancing techniques related to launching vehicles and satellites.

3) In particular, because of Japan's situation, the following urgently required techniques will be acquired at an early stage so that Japan will be able to meet international demand by the 1990s at the latest.

i. Techniques which enable Japan as a maritime nation to carry out various types of ocean observation and communications with mobile objects on and over the sea, including small craft and aircraft.

ii. Techniques for repetitive observation of resources, geophysical conditions and environmental conditions and their suitable application.

iii. Techniques for manufacturing materials in outer space.

3. Activities for the next 15 Years

During the next 15 years Japan is to carry out the following space development activities.

1) Space activities related to communications

The "mobile communications technology satellites series" to establish communications techniques is to be developed based on Japan's own technology. The "fixed communications satellites series", the "broadcasting satellites series" and the "mobile communications and navigation satellites series" will be developed aiming at practical use while promoting domestic production regarding the established programs and technical advancement based on the results of the above.

2) Space activities related to observation

The "astronomical observation scientific satellites series" and the "earth observation scientific satellites series" will be developed to carry out activities of the highest international level for scientific progression Japan. Other series to be developed are the "marine and land observation satellites series" for the purpose of establishing observation techniques based on Japan's own technology and for application of the results obtained, the "ionosphere magnetosphere and solid earth observation satellites series" and the "meteorological observation satellites series" to promote these areas in Japan and also to further the sophistication and application of established programs.

Furthermore, as the culmination of the techniques developed around the earth and also as a stepping stone for new developments in space technology, the "moon and planets exploration series" for probing the moon and the planets of the earth will be developed.

3) Experiments in space

In the field of experiments utilizing the environmental conditions found in outer space, the "material experiments series" and the "life science experiments series" will be developed, as they may have important industrial implications.

4) Techniques common to all satellites

As for satellite techniques commonly necessary to promote satellite activities in all fields, the standardization, systematization and performance improvement of onboard equipment will be pursued, space platforms and experiment subsystems onboard the Space Shuttle will be developed, and manned space activities will be initiated relying upon the United States in the early stages.

5) Techniques common to space transportation

i. Japan's launch vehicles will be in three series: M launch vehicles using solid fuel, N launch vehicles using petrolic fuel, and H launch vehicles using liquid hydrogen. They will be developed as representative launch vehicles, each corresponding to its payload. New types will not be developed; rather, the emphasis will be placed on increased capabilities for application.

ii. M launch vehicles

M launch vehicles will be used for small-scale missions as a simple system which is easy to operate.

iii. N launch vehicles

Domestic production of N-I and N-II launch vehicles will be promoted, and their standardization and interchangeability will be enhanced. Thus, they will be unified by 1983-84 so as to be used as Japan's main vehicle until the H-I vehicle can be put to use.

iv. H-I launch vehicles

The H-I launch vehicle will be developed as Japan's main vehicle for more than 10 years from about 1985.

The H-I launch vehicle is capable of launching a payload of about 4-5 tons into low earth orbit and 500-800 kg into geostationary orbit.

4. Promoting Space Development

In order to achieve the goals described above, it is necessary to improve the whole system of development in such a way that all the studies and activities may be carried out in a well coordinated and effective manner while maintaining the unity of such activities.

Therefore, the role played by each organization will be defined clearly and each organization will improve its system accordingly.

In order to promote space development based on autonomous technology, a system will be established in such a way that the research, development and application sectors can maintain

mutually effective and harmonious relations and results obtained from scientific satellites and those from applications satellites can be made available for mutual application. Therefore, sectors concerned with pioneering research and application studies and the development sector of the National Space Development Agency of Japan (NASDA) will increase their capacities. At the same time, there will be a center for testing and research which is open to all the related bodies for joint research to promote efficient planning for the country as a whole.

In promoting actual programs, bodies concerned will cooperate and share the work, if necessary, as members of the project promoted by the nation as a whole.

5. Consolidation of the Basis for Space Development

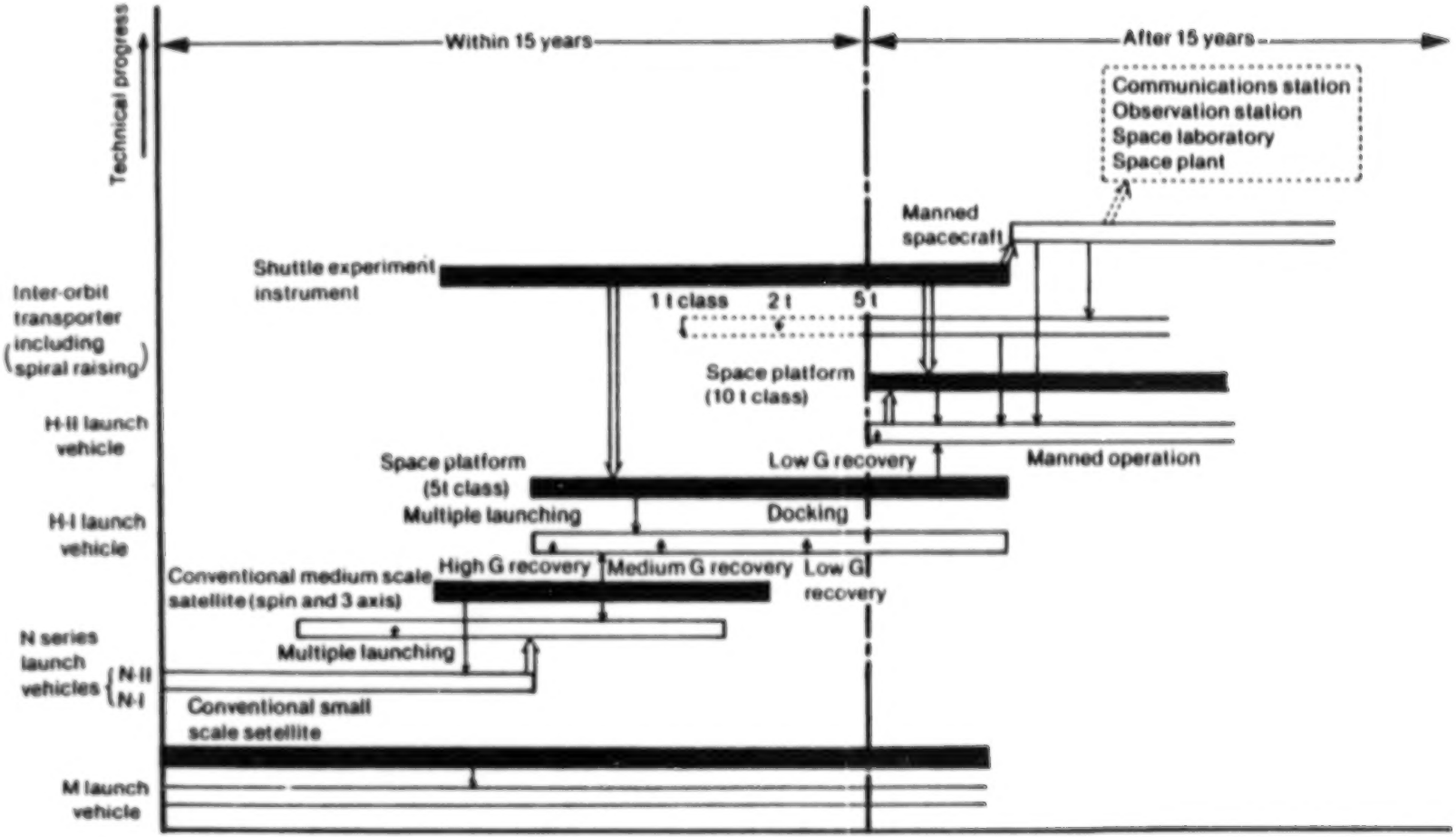
The direction and framework of related policies which are necessary to realize all the above mentioned activities effectively are as follows:

1) Basic research at universities and national research laboratories will be reinforced corresponding to the space development series. The technical capability of the private sector will be increased by digging out and nurturing expert manufacturers and promoting technology transfer and joint research.

2) International joint projects and multi-national collaboration and cooperation with developing countries will be promoted.

3) The environment in which space development is carried out will be improved by means of good public relations, personnel training and information circulation.

Scenario for Use of Common Technologies



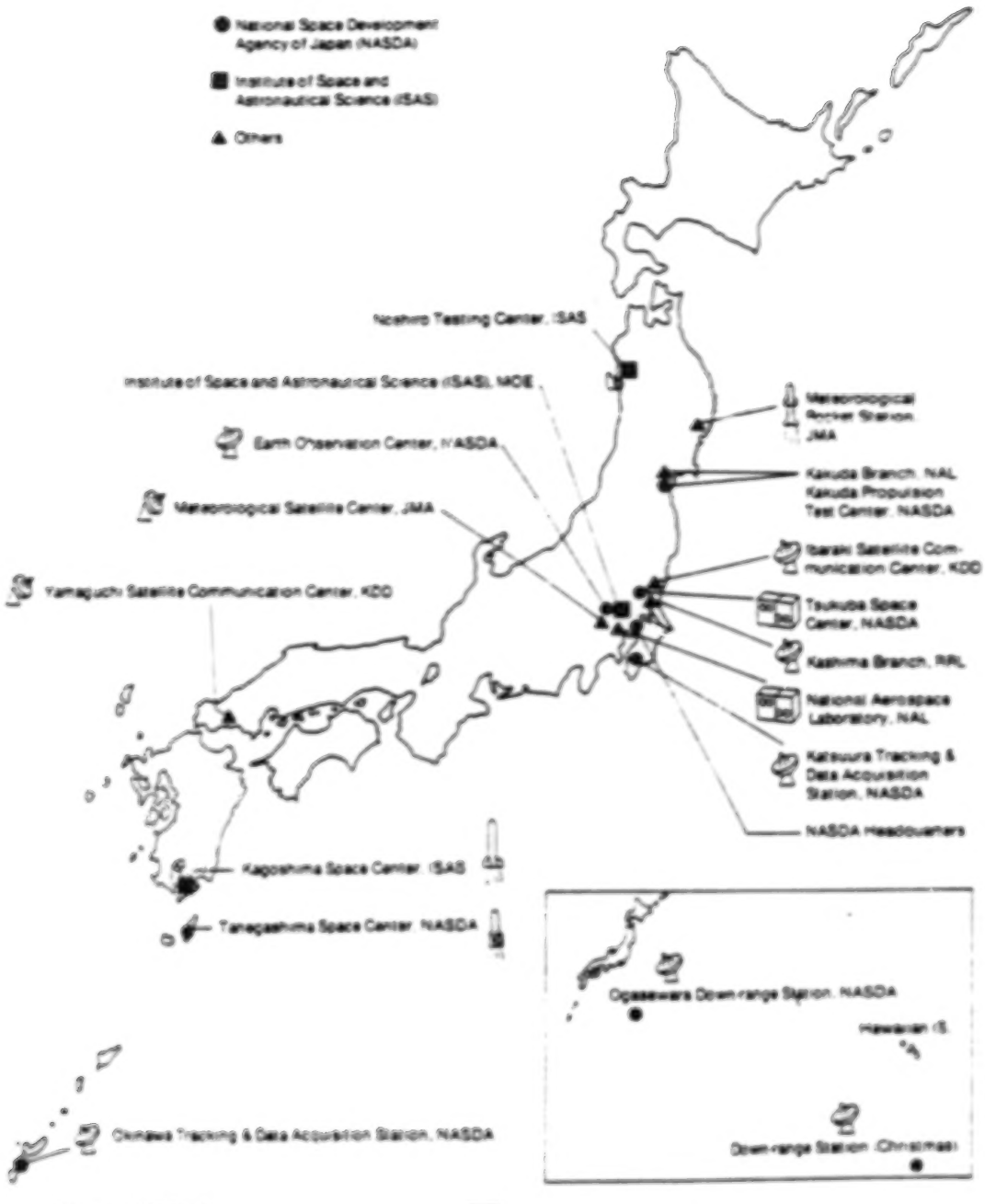
Notes: 1. This chart shows tasks and their interrelations in the field of common techniques.

2. ■■■ shows tasks in the field of techniques common to satellites. ▭ shows tasks in the field of techniques common to transportation.

3. ⟶ shows launch vehicles for satellites, etc. and ⟹ shows the direction of development of satellites, etc.

4. Actual structure and contents of each task are to be prescribed by the "Space development program", according to technical development, funds and other conditions.

Location of Major Facilities



CSO: 4120/110 END

END OF FICHE DATE FILMED

JAN 29 1982